RECORD OF DECISION
ASARCO GLOBE PLANT SITE
DENVER, COLORADO

Colorado Department of Health
4300 Cherry Creek Drive South
Denver, Colorado 80222

February 18, 1993

CONTENTS

TABLES

GLOSSARY AND ACRONYMS

Action Levels Soil contaminant levels that are established to protect the health of exposed individuals. In general, lower action levels reflect more conservative exposure assumptions and higher levels of protection.

ARARs Applicable, or Relevant and Appropriate Requirements, such as environmental regulations, that are pertinent to the hazardous substances found at CERCLA sites.

CERCLA Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (**SARA**) is the federal law that provides for investigation and cleanup of hazardous waste sites. The state seeks cleanup of the Asarco Globe site through CERCLA.

Control Stations Air quality monitoring stations that monitor ambient air quality in areas not believed affected by the Asarco Globe Plant.

EPA The federal Environmental Protection Agency is the federal agency responsible for environmental regulation and implementing CERCLA and the Superfund program.

EP Toxicity The Extraction Procedure Toxicity test is a methodology previously used to determine whether a substance should be managed as a hazardous waste. The test has been superseded by the TCLP test.

FGD Farmers and Gardeners Ditch is a buried three-foot diameter concrete pipe that carries irrigation and cooling water to the northeast along the Globe Plant site terrace.

FS or Feasibility Study A study conducted to identify and evaluate remedial alternatives for cleaning up the site.

Fugitive Emissions Emissions, such as windblown dust, that are not controlled and directed through the Plant stacks.

Hazard Index A method for assessing risk to humans of contracting non-cancerous health effects from contaminants associated with the site. Any hazard index that is greater than one is considered unacceptable.

HEPA Filters High Efficiency Particulate Air filters that are designed to efficiently remove contaminant particles by forcing the contaminated air through filtering material.

IDD The Industrial Drainage Ditch is a small ditch originating west of the Globe Plant, that flows along the west boundary of the Plant to 51st Avenue, where it discharges to a storm sewer. The storm sewer flows to a detention pond in the floodplain, and the detention pond discharges through an overflow pipe to the South Platte River.

FIGURES

Institutional Controls Measures, such as land use controls, that limit or prevent exposures to hazardous substances through legal restrictions.

MCLs Maximum Contaminant Levels are numerical standards for contaminants in drinking water supplies that serve over 25 people.

MCLGs Maximum Contaminant Level Goals are numerical goals for contaminants in drinking water supplies that serve over 25 people.

mg/kg milligrams per kilogram of contaminant concentrations in soil, the mass of contaminants in a unit mass of soil.

mg/l milligrams per liter of contaminant concentrations in liquid, the mass of contaminant in a unit volume of liquid.

NCP The National Oil and Hazardous Substances Pollution Contingency Plan contains the implementing regulations for CERCLA.

OSWER The US EPA Office of Solid Waste and Emergency Response manages the federal Superfund Program and develops guidance for the program.

ppb parts per billion is a method of expressing contaminant concentration, e.g., one part of contamination in one billion parts of liquid. The term ppb is the same ratio as ug/l.

ppm parts per million is a method of expressing contaminant concentration. The term ppm is the same ratio as mg/kg or mg/l.

Present Value Cost The total cost of a remedial alternative, including capital, long-term operation and maintenance costs, expressed in terms of today's dollars.

PHE or Public Health Evaluation A study conducted to calculate the potential health risks that the site would pose if no remedial actions are taken.

RAGS The Risk Assessment Guidance for Superfund (December 1989) is guidance developed by EPA detailing methodologies to be used when performing risk assessments at CERCLA sites. The RAGS guidance updates the previous SPHEM guidance.

Record of Decision The report issued by the state that documents the final remedy selection, explains why the remedy has been selected, and responds to public comment received on the Proposed Plan.

RCRA Subtitle C The laws and regulations which control treatment, management, and disposal of hazardous waste.

RI or Remedial Investigation A study conducted to determine the nature and extent of contamination at and surrounding the site.

SDWA Safe Drinking Water Act is the law that establishes standards for drinking water supplies. The SDWA sets out methods for establishing MCLs and MCLGs.

Secondary Containment Providing a second liner to capture any leakage from the first container.

Slurry Wall A barrier to ground water flow made by constructing a continuous wall of low permeability materials through the ground.

SPHEM The Superfund Public Health Evaluation Manual is guidance developed by EPA in 1986 that details methodologies to be used in conducting risk assessments at CERCLA sites. The SPHEM guidance was updated by RAGS guidance in 1989.

Stabilization Chemically and physically fixing contaminants. in place by mixing the contaminated materials with a stabilizing agent, which may be similar to concrete.

Synthetic Membrane (or Geomembrane) A continuous layer of extremely low permeability man-made material, such as plastic, designed and installed to prevent water movement through the membrane.

TCLP Total Concentrate Leaching Procedure is a testing procedure used to determine whether a substance is considered a hazardous waste.

ug/dl microgram per deciliter is a unit of measure for concentration in blood, for example, this term is often used in relation to lead concentrations in human blood samples.

UBK Uptake Biokinetic model is a risk management tool in evaluating impacts to human health from lead in the environment, including lead contamination in soil.

upper limit of background is the concentration of a chemical that is elevated above the normal range of concentrations of that chemical that would exist if the contaminant source were not present. Concentrations of contaminants of concern that are above the upper limit of background in the Globe Plant area can be attributed to the Globe Plant site.

Venturi Scrubber A method for removing contaminant particles from an air stream by increasing the speed of the air stream and directing it through a water spray that traps the particles.

DECLARATION

Site Name and Location

Asarco Globe Plant Site
Denver, Colorado

Statement of Basis and Purpose

This decision document presents the selected remedial actions for the Asarco Globe Plant Site in Denver, Colorado, chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et. seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy for this site. The information supporting this remedial action decision is contained in the Administrative Record for this site.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Remedy

The Asarco Globe Plant Site consists of four operable units (OUs) involving the Asarco Globe Plant property and surrounding properties that are contaminated with metals as a result of Globe Plant operations. The major problems consist of the Former Neutralization Pond waste pile that contributes to ground water contamination (OU 1), a ground water contaminant plume flowing off the Plant site to the northeast and contaminated sediments in the Industrial Drainage Ditch (IDD) and Retention Ponds (OU 2), community soils contaminated with arsenic, cadmium, zinc and lead (OU 3), and Plant site soils and ground water contamination and continued air emissions of cadmium and lead (OU 4).

The selected remedies for the Asarco Globe Plant Site address the principal threats at the site through:

- Containing and closing the former neutralization pond to cut off this source of ground water contamination.
- Excavating and disposing of IDD and Retention Ponds sediments to remove the possibility of ingestion.
- Capping or removing Detention Pond sediments that become exposed and exceed soil action levels to remove the ingestion health threat.
- Installing a terrace drain to cut off the release of contaminated ground water from the Plant site to the floodplain aquifer.
- Excavating and removing, capping, controlling exposure to, or deep tilling of contaminated community soils to minimize the ingestion and inhalation health threats.
- Excavating, capping, controlling exposure to, or deep tilling Plant site soils above worker or trespasser action levels to minimize the ingestion and inhalation health threats.
- Covering and vegetating the lead slag pile to minimize fugitive emissions from this area.
- Excavating and stabilizing contaminated Plant site sediments to remove this source of ground water contamination.
- Before use, sealing Plant floors and sumps in wet operations, with secondary containment in required Plant sumps to prevent ground water contamination.
- Installing further air pollution point source and fugitive emission controls to reduce the inhalation health threat.
- Use of institutional controls, maintenance, and monitoring to supplement the remedy and to assure the protectiveness of the selected remedy into the future.

Statutory Determinations

The selected remedies are protective of human health and the environment, comply with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and are cost effective. The remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. Portions of the remedies satisfy the statutory preference for remedies that employ treatment to reduce toxicity, mobility, or volume as a principal element. For other portions of the remedies, technical infeasibility and inadequate short-term protection of human health and the environment preclude use of treatment.

Because the remedies will result in hazardous substances remaining on-site above health based levels, and because the ground water remedy involves source control and attenuation of existing contamination over time, a review will be conducted no less than every 5 years after commencement of remedial action to ensure that the remedies continue to provide adequate protection of human health and the environment.

Thomas P. Looby

Thomas P. Looby
Director, Office of Environment
Department of Health
State of Colorado

2/18/93
Date

INTRODUCTION

Based on the Remedial Investigation, the Public Health Evaluation, the Feasibility Study, the Air Engineering Design Study, the Proposed Plan, the public comments received, and the Administrative Record, the Colorado Department of Health presents the Record of Decision for the Asarco Globe Plant site (the site). The Record of Decision provides a summary of the findings of the Remedial Investigation/Feasibility Study, actual and potential risks to human health and the environment, and the selected remedy. The state followed EPA guidance[1] in preparation of the Record of Decision. The Record of Decision has the following three purposes:

1. Certify that the remedy selection process was carried out in accordance with the requirements of the Comprehensive Environmental, Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., and to the extent practicable, the National Contingency Plan (NCP), 40 C.F.R. Part 300;
2. Outline the engineering components and remediation goals of the selected remedy; and
3. Provide the public with a consolidated source of information about the history, characteristics, and risks posed by the conditions at the site, as well as a summary of the cleanup alternatives considered, their evaluation, and the rationale behind the selected remedy.

The Record of Decision is organized into three distinct sections:

- The Declaration functions as an abstract for the key information contained in the Record of Decision;
- The Decision Summary provides an overview of the site characteristics, describes the alternatives evaluated, and provides an analysis of these alternatives. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements; and
- The Responsiveness Summary addresses public comments received on the Proposed Plan and throughout the remedy selection process.

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[1] Guidance on Preparing Superfund Decision Documents: The Proposed Plan, the Record of Decision, Explanation of Differences, the Record of Decision Amendment, Interim Final, EPA/540/G, July 1989.

FIGURE 1

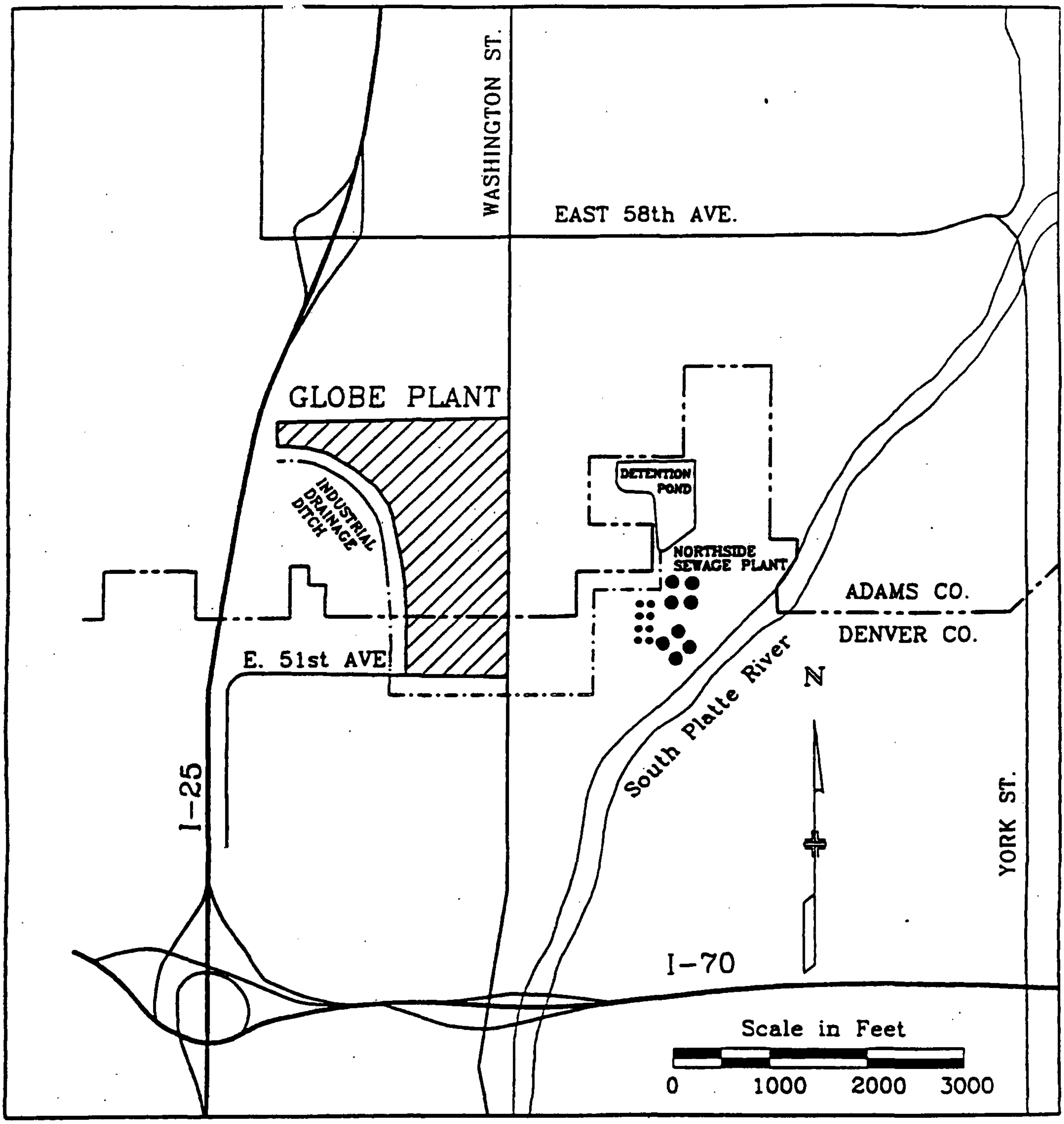


Figure 1 Site Vicinity Map

THE DECISION SUMMARY

SITE DESCRIPTION

The Asarco Globe Plant (Plant) is located at 495 East 51st Avenue, Denver, Colorado (Figure 1) and straddles the boundary between the City and County of Denver and Adams County. It is several blocks northeast of the intersection of Interstates 70 and 25. The site is situated along the west edge of the South Platte River floodplain, 2.7 miles upstream of the river's confluence with Clear Creek. The majority of the 89 acre site is located on a terrace that rises about 30 to 60 feet above the floodplain. The southeast portion of the site is in the floodplain. The Globe Plant includes 53 buildings used for production, offices, and wastewater treatment (Figure 2), a low mound of precipitates remaining from the Former Neutralization Pond, and a deposit of blast furnace slag from historic lead smelting operations. The slag deposit, situated on the surface of the floodplain along the edge of the terrace, is approximately 15 feet thick, up to 300 feet wide, and 1100 feet in length. The precipitates in the former neutralization pond area are 11 to 17 feet thick and cover approximately 7 acres. The top surface is graded toward the southwest and is covered with 6 inches of clayey soil that is vegetated with native grasses.

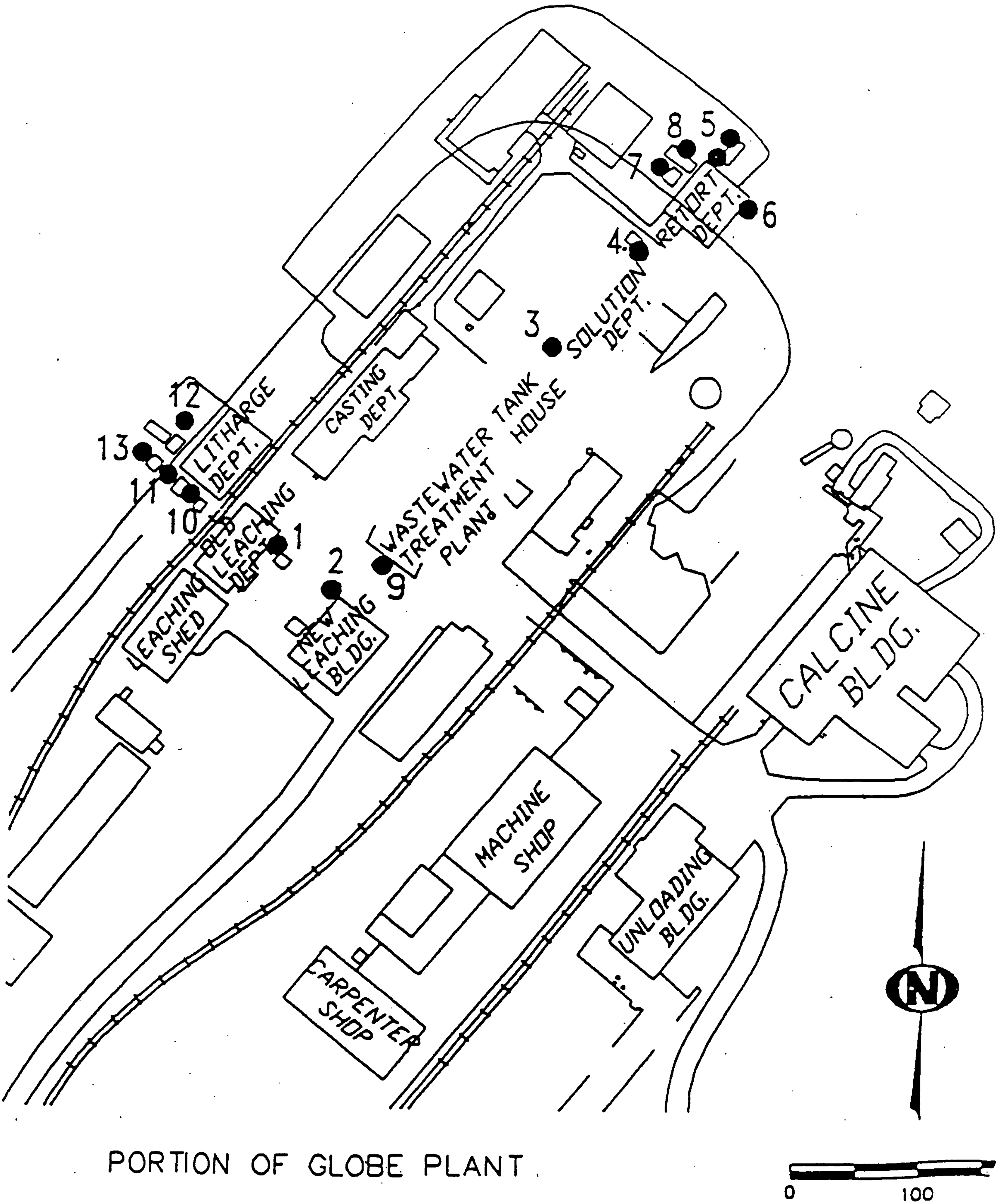
The southeastern and northwestern corners of the property are open grassland and are not used for Plant operations.

Ground Water Systems

Two principal ground water systems exist in the Globe Plant area: 1) a shallow system in sand and gravel deposits and shallow weathered sandstone, and 2) a deeper system in permeable beds of the Denver Basin bedrock formations. The shallow ground water system is underlain by an extensive, low permeability claystone deposit of the Denver formation. Shallow ground water on the terrace generally flows in a southeast direction toward the floodplain, where the ground water then flows northeast, toward the river. Ground water within the floodplain is considered tributary to the Platte River.

The deep bedrock aquifers beneath the site area are separated from the shallow ground water system by more than 70 feet of low permeability claystone. Deep ground water flow below the site is eastward toward a low point in the water table created by several decades of well pumping in the Denver area.

FIGURE 2



PORTION OF GLOBE PLANT

Surface-Water Systems

Surface water bodies and flow systems in the Globe Plant area include the South Platte River, an Industrial Drainage Ditch west of the site, and the Farmers and Gardeners Ditch. The major surface water body in the area is the South Platte River that flows from the central Rocky Mountains north through Denver to its confluence with the North Platte River in Nebraska. The small ditch originating west of the Globe Plant, known as the Industrial Drainage Ditch (IDD), flows along the west boundary of the Plant through the Retention Ponds to 51st Avenue, where it discharges to a storm sewer. The storm sewer flows to a Detention Pond in the floodplain, and the Detention Pond discharges through an overflow pipe to the South Platte River. The Farmers and Gardeners Ditch (FGD) conveys water to the northeast along the edge of the terrace through a buried three foot diameter concrete pipe.

Surrounding Area Land Use

The Globe Plant site is located in a mixed land use area. Within a one mile radius of the Plant, 9.5 percent of the land is currently residential and 1.0 percent is used for farming. The remaining 89.5 percent of the land is commercial and industrial, with 4.5 percent of the land occupied by the Globe Plant. Residential areas immediately adjacent to the Globe Plant are located to the southwest and southeast of the Plant. A mixed residential and commercial area is situated north of the northern boundary of the Plant, 55th Avenue.

The Globe Plant is located partially in the community of Globeville, which extends southward from the Adams County line and is bounded by the South Platte River to the east and south, and Inca Street to the west. The 1985 estimated population of Globeville was 3682 (Denver Planning Office, 1988). The 1985 estimated population of the area north of the Globe Plant, specifically the portion of Adams County south of Clear Creek between York Street and Pecos Street, was 915 (Adams County Planning Office, 1988).

SITE HISTORY AND ENFORCEMENT ACTIONS

The Asarco Globe Plant, originally owned by a small group of local businessmen and known as the Holden Smelter, began operations in 1886 producing gold, silver, lead, and copper. In 1888, Benjamin Guggenheim bought a sizable interest in the property, which became the Globe Plant. When the American Smelting and Refining Company (renamed Asarco Incorporated in 1975) bought the Globe Plant property in 1901, the Plant was converted to lead smelting. Lead smelting was replaced by arsenic trioxide production in 1921, that continued until 1926. The Plant was then converted to cadmium production and has produced cadmium up to the present date, along with litharge, test lead, and occasionally thallium, indium, and other high purity metals such as antimony, copper, and tellurium. The property currently under Asarco's ownership consists of approximately 89 contiguous acres. Historically, Asarco also owned a 50 acre tract (based on a 1925 survey) east of its current property, known as the "Asarco Annex". Beginning the in 1940s and continuing until 1986, Asarco disposed of most of its wastewater in an unlined pond in the northern area of the Plant. This area is now known as the Former Neutralization Pond (see Summary of Site Characteristics).

The Colorado Department of Health (CDH) Water Quality Control Division collected water and sediment samples from the IDD in 1974 and detected elevated concentrations of cadmium, lead and some other metals. In 1980 and 1981, CDH found the site to be out of compliance with the Colorado Solid Waste Disposal Sites and Facilities Act. Subsequent to the investigations and inspections conducted by the CDH, EPA listed the Asarco Globe Plant on the open dump inventory for 1981 under the Resource Conservation and Recovery Act (RCRA) Section 4000 criteria. A preliminary uncontrolled hazardous waste site ranking, as defined by the NCP, was conducted in 1982 by the Fred C. Hart and Associates Field Investigation Team (FIT) (F.C. Hart, 1982). The Fred C. Hart FIT sampled soils, sediments, wastes, and surface water at the site and vicinity in December 1982. Three ground water monitoring wells were installed on site during this time.

EPA contracted Ecology and Environment, Inc. to complete the field investigation started by Fred C. Hart and Associates in 1982. The Ecology and Environment FIT accompanied the Fred C. Hart FIT on their sampling efforts and completed sampling of the three ground water wells in January 1983. A report completed in June 1983 provided a summary and interpretation of the data collected during the FIT investigations of 1982 and 1983 (Ecology and Environment, Inc., 1983).

In September 1982, the EPA National Enforcement Investigations Center (NEIC) conducted airborne particulate sampling on the Plant site. A subsequent report presented the results of the sampling effort and a limited characterization of the sampled particulate (USEPA, 1982).

In December 1983, CDH sued Asarco for damages to natural resources under CERCLA in State of Colorado v. Asarco, Inc., Civ. No. 83-C-2383, (D. Colo.). In 1985, the state amended the complaint to allege, among other things, that Asarco was liable to the state for the costs of response actions taken by the state. In 1985, the federal District Court held that Asarco was liable to the state for at least some natural resource damages and some response costs. Asarco and the CDH initially conducted separate investigations. In 1986, CDH issued an administrative Compliance Order against Asarco alleging violations of hazardous waste management requirements under the Colorado Hazardous Waste Management Act and its implementing regulations. This Compliance Order was resolved in 1987 under a Compliance Order Upon Consent. Also in 1987, the state and Asarco entered into a Memorandum of Agreement (MOA) to conduct joint studies to assess and clean up the site in a manner consistent with the requirements of the NCP, undertake some interim remedial actions, and facilitate a negotiated settlement of litigation.

In January 1988, Midwest Research Institute (MRI), under contract to EPA, completed a study of potential health risks attributed to cadmium emissions from six source categories at the Asarco Globe Plant (MRI, 1988).

A comprehensive Remedial Investigation (RI) (TRC, 1988), Public Health Evaluation (PHE) (Putnam, 1989) and Feasibility Study (FS) (TRC, 1990) were conducted as part of a joint investigation of the Globe Plant site by Asarco and its consultants, with oversight and assistance by CDH and its consultants. The joint investigation was conducted in a manner consistent with the NCP and in accordance with CERCLA and the MOA between Asarco and CDH. The objectives of the RI at the Globe Plant site were to determine the extent, magnitude, sources, and impacts, if any, of contamination due to releases of hazardous substances from the site, and to gather necessary data to assist in preparation of the PHE and the FS. The RI consisted of six tasks including a source inventory, air monitoring, and investigations of ground water, surface water, soil, and vegetation at the site. The results of the RI are the subject of a multiple volume report released in draft form on September 29, 1988, and finalized on March 12, 1992.

The PHE was prepared to evaluate the potential impact on human health from the site if no remedial actions were to occur. The PHE report was released in draft form in July 1989, and was finalized on April 15, 1992.

The purpose of the FS was to develop and evaluate alternatives that are potentially available to address public health, environmental and welfare concerns posed by the release of hazardous substances from the Globe Plant. The FS report was released in draft form in August, 1990, and finalized on May 29, 1992.

Upon receipt and consideration of public comment, the most appropriate alternatives evaluated in the FS were selected and presented for public consideration in the Proposed Plan for Cleanup of the Asarco Globe Plant Site dated October 1992. After receipt and consideration of public comment on the Proposed Plan, the selected remedial alternatives are documented in this Record of Decision (ROD).

REMEDIAL ACTIONS COMPLETED TO DATE

A number of remedial actions have been implemented by Asarco during the course of the RI, in order to address immediate concerns while remaining consistent with potential longer term remedial measures. These actions include:

- Construction of a new wastewater treatment Plant in June 1986;

- Repairs to the FGD pipe in 1987 and 1988 to reduce the concentrations of cadmium in the ditch water to levels that meet CDH irrigation water standards;

- Installation of a ground water interception drain adjacent to the Farmers and Gardeners Ditch (FGD) in the summer of 1988 to prevent ground water infiltration into the pipe;

- Regrading and covering of the Former Neutralization Pond precipitates with six inches of clayey soil and vegetation in 1986 to prevent blowing of precipitates and to minimize infiltration of rainwater;

- Provision of city water to a residence south of the Globe Plant site to replace contaminated shallow ground water supplies (although the source of contamination is unlikely to be related to the Globe Plant);

- Installation of improved air emission controls and elevation of stack heights in 1987 and 1988, respectively. In 1989, one additional baghouse was installed at the litharge department, and one was installed at the cadmium retort department;

- Excavation and removal of an old tile pipe in 1985 that conveyed water from an unknown source to the Industrial Drainage Ditch; and

- Erection of security fencing around the IDD in 1985.

HIGHLIGHTS OF COMMUNITY PARTICIPATION

CERCLA, as amended by SARA, Sections 113(k)(2)(B)(i-v) and 117, requires that federal and state remedial agencies keep the community informed, and allow the community to participate in the decision-making process. The legislation requires at a minimum: (1) notice to potentially affected persons and the public of the availability of the proposed plan; (2) reasonable opportunity to comment of not less than 30 days on the proposed plan and supporting analysis and information, including the RI/FS; (3) an opportunity for public hearing on the proposed plan and supporting information; (4) written summary of and response to each significant comment submitted on the proposed plan; and (5) statement of the basis and purpose of the selected action.

This section describes the specific community participation activities that occurred in the process of selecting a remedy for this site. These activities indicate a commitment by the state of Colorado to meet both the letter of the law and the spirit of community participation at this site. In addition, this ROD fulfills two requirements of CERCLA: (1) it contains a response to each comment submitted by the public (see the Responsiveness Summary); and (2) it provides a statement of the basis and purpose of the remedy.

A community relations plan for the site was prepared in January of 1986 and was revised on March 17, 1989. Two mailing lists of persons interested in the site were developed to keep the public informed. A general mailing list was developed for larger public meetings and issues of general interest. This list includes state of Colorado elected officials, City and County of Denver officials, Adams County officials, area media, community organizations, as well as approximately 600 area residents. A working group mailing list of approximately 70 individuals and entities was also developed for those, including leaders of local community organizations and governmental representatives, interested in more frequent updates on site status.

Numerous public meetings have been held in the Globeville area to discuss the site. Project staff also met with concerned citizens, city and county representatives, local community groups, and EPA representatives to discuss the site. Below is a list of public meeting dates and topics:

Date	Regarding
1/28/86	Role of the community
10/12/88	Discuss Draft Remedial Investigation Report
3/21/89	Informational meeting
6/1/89	Informational meeting
8/1/89	Informational meeting
8/22/89	Discuss Public Health Evaluation Report
1/31/90	Leadership Working Group meeting
3/6/90	Working Group meeting
9/26/90	Discuss Draft Feasibility Study
2/13/91	Working Group meeting
4/10/91	Working Group meeting
6/12/91	Working Group meeting
1/23/92	Working Group meeting
3/26/92	Working Group meeting
6/2/92	Working Group meeting
9/17/92	Working Group meeting
10/28/92	Discuss Proposed Plan
11/17/92	Working Group meeting, discuss Proposed Plan
12/1/92	Receive oral comments on Proposed Plan
1/27/93	Working Group meeting
2/10/93	Working Group meeting

Press releases were also issued to inform the community on the site status. Press releases were issued as follows:

Date	Topic
10/2/85	Well water in Globeville neighborhood may be unsafe

12/13/85	Background information on lawsuit and cadmium
1/24/86	Announcement of a public meeting for Jan. 28, 1986
1/5/87	Announcement that CDH will begin door-to-door survey to investigate ground water contamination
4/8/87	Agreement in principle to settle litigation in Colorado v. Asarco
10/7/87	Joint presentation by CDH and Asarco on 10/13/87 Re: contamination at site
9/29/88	Results of contamination study in Draft Remedial Investigation Report
7/25/89	Report evaluating contamination at site
11/7/89	CDH announcement that blood lead screening showed no unsafe levels of lead
4/10/90	Asarco to provide garden space for Globeville community
10/10/90	Extension of public comment period for Feasibility Study
11/19/90	CDH announcement that urine tested for cadmium showed no significant amounts of heavy metal
8/21/91	Response to media inquiries re: filing of class-action lawsuit
10/14/92	Release of Proposed Plan

Fact sheets and handouts have been published and distributed at project milestones. Fact sheets and their topics are as follows:

Date	Topic
No date avail.	Handout/What Every Parent Should Know About Metals in the Environment
1/14/86	Handout/Fact Sheet Asarco Globe Plant
10/86	Cadmium Fact Sheet
1988	Fact Sheet on Cadmium for Gardeners in the Globeville Neighborhood
9/20/88	Executive Summary for Draft Remedial Investigation Report
8/1/89	Health Risk Fact Sheet
8/90	Executive Summary for Draft Feasibility Study Report
11/19/90	Health issues fact sheet
11/19/90	Spanish language translation of health fact sheet
10/14/92	Proposed Plan for Cleanup at Asarco Globe Plant Site
10/14/92	Spanish language translation of Proposed Plan
10/92	Questions and Answers fact sheet on Proposed Plan
10/92	Spanish language translation of Q&A fact sheet
10/92	Proposed Air Remedy fact sheet
10/92	Spanish language translation of air remedy fact sheet
10/92	Public Comment Self Mailer
11/92	Draft Medical Monitoring Plan
11/92	Information on ATSDR Environmental Media Evaluation Guides

12/1/92	Deriving a Soil Criterion for Cadmium
1/93	Health Consultation from ATSDR on soil cadmium action level
1/93	Discussion of ATSDR EMEG issues
1/93	Summary of residual risks
1/93	Residual risk from inhalation of wind-blown dust

The RI, PHE, and FS reports were issued in draft form and were made available to the public for comment. Extensive public comments were received on each document; these comments were considered when the documents were finalized. Public meetings were held to discuss the findings of each of these documents. Transcripts of these public meetings are available in the Administrative Record. The final versions of each document included detailed responses to the public comments received. Public meetings addressing the Proposed Plan were held on October 28, November 17, and December 1, 1992. Transcripts of the November 17 and December 1 meetings are included in the Administrative Record. A summary of the comments received, written or oral, and responses are contained in the Responsiveness Summary of this Record of Decision.

Information repositories containing the primary documentation for the site have been provided at the Globeville Civic Association, the Commerce City Branch Library, and the Globeville Area Business Association, all located close to the site. The complete Administrative Record is available at CDH, the Colorado Attorney General's Office, the Central Denver Public Library, and the Stapleton Recreation Center in Globeville.

SCOPE AND ROLE OF THE RESPONSE ACTION

The site has been broken into several areas of concern, defined as "operable units." The operable units are as follows: the Former Neutralization Pond, ground water and surface water, community soils, and the Plant site.

There are several health risks posed by the site, depending on extent of exposure. Extent of exposure depends on frequency and length of exposure, contaminant concentrations at the point of exposure, and other age-specific exposure factors. Contaminated community soils and IDD sediments pose an ingestion threat to community residents. Contaminated Plant site soils and sediments pose an ingestion threat and may pose an inhalation threat to workers and trespassers. The Former Neutralization Pond materials and contaminated Plant site sediments also act as sources of ground water contamination, although current concentrations appear to be less than historic levels. Continued emissions from the operating Plant pose an inhalation risk to community residents, depending on emission rates and extent of exposure. The contaminated ground water poses a potential health threat to any residents who may use this ground water as a drinking water source, although the state has conducted water well use surveys in 1987 and 1992 and found no individuals who currently use this ground water as a drinking water supply.

The selected remedies will address the principal threats through:

- Containing and closing the Former Neutralization Pond to cut off this source of ground water contamination.

- Installing a terrace drain to cut off the release of contaminated ground water from the Plant site to the floodplain aquifer, with treatment of the collected contaminated ground water.

- Excavating and disposing of IDD and Retention Ponds sediments to remove the possibility of ingestion.

- Capping or removing Detention Pond sediments that become exposed and exceed soil action levels to remove the ingestion health threat.

- Excavating and removing, capping, controlling exposure to, or deep tilling of contaminated community soils to minimize the ingestion and inhalation health threats.

- Excavating, capping, controlling exposure to, or deep tilling Plant site soils above worker or trespasser action levels to minimize the ingestion and inhalation health threats.

- Covering and vegetating the lead slag pile to minimize fugitive emissions from this area.

- Excavating and stabilizing contaminated Plant site sediments to remove this source of ground water contamination.

- Before use, sealing Plant floors and sumps in wet operations, with secondary containment in required Plant sumps to prevent ground water contamination.

- Installing further air pollution point source and fugitive emission controls to reduce the inhalation health threat.

- Use of institutional controls, maintenance, and monitoring to supplement the remedy and to assure the protectiveness of the selected remedy into the future.

SUMMARY OF SITE CHARACTERISTICS

Based on the results of the RI, arsenic, cadmium, lead, and zinc have been identified as the indicator chemicals at the Globe Plant site. No evidence of significant contamination due to releases of other substances from the Globe Plant was found during the investigation. Other metals found in low concentrations and/or in limited areal extent in water and soil include antimony, barium, cobalt, nickel, copper, manganese, selenium, and thallium. Table 1 (Table 2.1 from the Public Health Evaluation) presents the range of metals concentrations found on- and off-site in ground water, surface water, soil, and air. Organic priority pollutant analyses were conducted on ground water (GW-1, GW-3, BH-11, BH-12) and surface water (IDD, interceptor trench, Former Neutralization Pond water). The analytical results indicate that organic contaminants, including methylene chloride and pentachlorophenol, are found in both ground water and IDD water upgradient from the site and are believed not associated with the site. Table 2 (Table 4.4 from the RI) presents the results of this organic priority pollutant sampling.

Investigations of past and present materials and activities were conducted to evaluate potential sources of contamination. These materials include feedstocks, process materials, products, and by-products. Other materials include lead blast furnace slag from the former lead smelting operations (1901 to 1919), sediments in a former pond in the northeast corner of the site, and precipitates from the Former Neutralization Pond (1948 to 1986). Spent electrolyte solutions that are no longer generated at the Globe Plant may have been disposed south of the Former Neutralization Pond area in the early 1930s.

The extent and sources of contamination in each of the environmental media are described below. The development and evaluation of alternatives will focus upon these response areas.

Ground Water

Shallow ground water at and downgradient from the Globe Plant has elevated levels of cadmium, zinc, and arsenic. There are no elevated levels of lead in the shallow ground water system. The ground water investigation found no contamination of deep bedrock aquifers due to release of metals from the Globe Plant site.

No private wells were found to be contaminated with arsenic, cadmium, lead, or zinc as a result of migration from the Globe Plant. Two shallow wells in the floodplain south of the Globe Plant were found to have elevated cadmium concentrations. These two wells are upgradient from the Globe Plant. No evidence exists that the Globe Plant contributed to the contamination of these two wells.

The extent of cadmium, zinc, and arsenic contamination in shallow ground water is discussed below. Table 1 includes the results of the ground water investigation conducted during the RI. The toxicity and carcinogenicity of the indicator metals are discussed in the Summary of Site Risks section.

TABLE 1

TABLE 2-1 SCORING FOR INDICATOR CHEMICALS / CONCENTRATIONS IN ENVIRONMENTAL MEDIA ON-SITE AND OFF-SITE MEASUREMENTS (from PHE)

Chemical CAS #	Ground Water (mg/l) Range	Ground Water (mg/l) Rep	Surface Water (mg/l) Range	Surface Water (mg/l) Rep	Soil (mg/kg) Range	Soil (mg/kg) Rep	Air (mg/M3) Range	Air (mg/M3) Rep
Aluminum 7429-90-5	<.07 to 32	1.4	0.11 to 2.52	0.6	NA*	NA	NA	NA
Antimony 7440-36-0	0.01 to 0.3	0.1	<.05 to <0.1	<0.06	9 to 442	61	ND+ to 0.00003	ND
Arsenic 7440-38-2	0.003 to 128	1.3	<.004 to 0.19	0.05	3 to 6770	117	<0.00001 to 0.00012	0.00002
Barium 7440-39-3	0.07 to 0.3	0.1	0.046 to 0.22	0.08	85 to 344	200	0.00004 to 0.0001	0.00008
Beryllium 7440-41-7	<.001 to 0.02	0.004	<.001 to <.002	0.001	NA	NA	ND	ND
Boron 7440-42-8	0.2 to 0.1	0.5	0.42 to 1.4	0.8	NA	NA	NA	NA
Cadmium 7740-43-9	<.001 to 82	5.5	<.001 to 0.84	0.06	1 to 9900	184	<0.000005 to 0.0014	0.0002
Chromium 7440-47-3	<.02 to 0.08	0.008	<.005 to <.01	<0.006	NA	NA	ND to 0.00001	0.000001
Cobalt 7440-48-4	<.003 to 1.5	0.1	<.003 to 0.052	0.02	5.2 to 14	7.4	NA	NA
Copper 7440-50-8	0.008 to 0.03	0.02	0.003 to 0.043	0.02	19 to 295	89	0.0003 to 0.002	0.0006
Indium 7440-74-6	0.02 to 0.07	0.04	NA	NA	<1 to 21	5	NA	NA
Iron 15438-31-0	0.02 to 149	4.3	0.21 to 10.3	2.7	6200 to 79600	17000	NA	NA

*NA = No Analysis +ND = Not Detected

TABLE 1

TABLE 1 (continued)

TABLE 2-1 (continued) SCORING FOR INDICATOR CHEMICALS / CONCENTRATIONS IN ENVIRONMENTAL MEDIA ON-SITE AND OFF-SITE MEASUREMENTS (from PHE)

Chemical CAS #	Ground Water (mg/l)		Surface Water (mg/l)		Soil (mg/kg)		Air (mg/M3)	
	Range	Rep	Range	Rep	Range	Rep	Range	Rep
Lead 7439-92-1	<.005 to 0.83	0.02	<.005 to 0.113	0.01	20 to 11500	498	<0.0005 to 0.0063	
Manganese 7439-96-5	<.008 to 318	11	0.089 to 6.7	3	93 to 926	375	0.00006 to 0.0002	
Mercury 7439-97-6	<.000001 to <.00050	ND	ND	ND	NA*	NA	NA	NA
Molybdenum 7439-98-7	<.005 to 0.1	0.018	<.005 to 0.048	0.019	NA	NA	NA	NA
Nickel 7440-02-0	0.03 to 0.09	0.04	<.01 to 0.06	0.02	8 to 28	14.5	ND	ND
Selenium 7782-49-2	<.004 to 0.015	0.01	<.003 to <.006	<.005	1 to 153	118	ND to 0.000003	ND
Silver 7440-22-4	<.002 to 0.04	0.01	<.003 to <.006	<.004	1 to 12	3.1	ND to 0.000001	ND
Strontium 7440-24-6	0.4 to 9.49	2.2	0.38 to 2.3	1.3	NA	NA	NA	NA
Thallium 7440-28-0	0.02 to 0.07	0.04	<.008 to <.2	<.06	<1 to 27	6.9	ND	ND
Tin 7440-31-5	<0.03 to 0.6	0.1	<0.03 to <0.6	<.08	NA	NA	NA	NA
Titanium 7440-32-6	<.002 to 0.04	0.01	<.002 to 0.084	0.014	NA	NA	NA	NA
Vanadium 7440-62-2	<.002 to 0.04	0.007	<.002 to 0.006	0.003	NA	NA	NA	NA
Zinc 7440-66-6	<.008 to 1650	72	<.008 to 16.4	0.78	65 to 107500	1178	0.00008 to 0.0003	0.0002

TABLE 1 (continued)

TABLE 2

TABLE 4.4
(from the RI)
ORGANIC PRIORITY POLLUTANTS DETECTED IN GROUNDWATER AND SURFACE WATER ASARCO GLOBE PLANT SITE

SAMPLE DATE	GW-1 9/18/85	GW-3 9/18/85	BH-11 9/18/85	BH-12 9/18/85	OD-3 (GT-226) 10/23/85	ID-A 9/18/85	ID-C 9/18/85	Trench #1 9/18/85	Trench #2 9/18/85	NP-A 9/18/85
<u>VOLATILE ORGANICS</u>										
Methylene chloride (ug/l)	240	BDL	280	2900	BDL	26	BDL	13	24	BDL
Benzene (ug/l)	21	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Tetrachloroethylene (ug/l)	BDL	24	10	BDL	45	BDL	BDL	BDL	BDL	BDL
<u>ACID EXTRACTABLES</u>										
Pentachlorophenol (ug/l)	28	BDL	BDL	BDL	BDL	BDL	580	BDL	BDL	BDL
<u>BASE/NEUTRALS</u>										
Acenaphthene (ug/l)	BDL	BDL	BDL	BDL	BDL	BDL	38	BDL	BDL	BDL
4-Chlorophenyl (ug/l)	BDL	BDL	BDL	BDL	BDL	BDL	28	BDL	BDL	BDL
Phenanthrene (ug/l)	BDL	BDL	BDL	BDL	BDL	BDL	26	BDL	BDL	BDL
Fluoranthene (ug/l)	BDL	BDL	BDL	BDL	BDL	BDL	26	BDL	BDL	BDL
Pyrene (ug/l)	BDL	BDL	BDL	BDL	BDL	BDL	17	BDL	BDL	BDL
<u>PESTICIDES</u>	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Note: Samples analyzed by CompuChem, Chapel Hill, North Carolina

TABLE 2

Cadmium and Zinc:

The results of the ground water investigation show that much of the shallow ground water beneath the Plant contains elevated concentrations of dissolved cadmium and zinc. On-site cadmium concentrations range in value from <0.001 mg/l to 237 mg/l, while on-site zinc concentrations range from <0.008 mg/l to 1650 mg/l. The current Safe Drinking Water Act (SDWA) Maximum Contaminant Level (MCL) for cadmium is 0.005 mg/l. The current SDWA Maximum Contaminant Level Goal (MCLG) for cadmium is also 0.005 mg/l. The approximate extent of cadmium concentrations exceeding 0.01 mg/l (the SDWA cadmium MCL at the time of the RI) in shallow ground water is shown on Figure 3. The extent of zinc concentrations exceeding 5 mg/l (the SDWA MCL for zinc) is less than the extent of cadmium contamination.

The cadmium and zinc plume originates on the terrace and extends southeast to the edge of the terrace. The plume then bends sharply to the northeast following the direction of ground water flow in the floodplain. Cadmium and zinc concentrations are one to two orders of magnitude lower in the floodplain than on the terrace. Maximum off-site cadmium and zinc concentrations measured during the remedial investigation were 2.62 mg/l and 7.60 mg/l, respectively. The plume in the floodplain appears to extend as far as the South Platte River.

There may be more than one source of cadmium and zinc contamination in the shallow ground water system at the Globe Plant site. In the northeast corner of the Plant site, fill material and a former sedimentation pond may be the principal source of cadmium and zinc contamination, with contributions from the solution department area of the Plant. Shallow ground water appears to be leaching metals from the fill material and the former sedimentation pond, while cadmium and zinc concentrations are elevated in wells downgradient of the tank house and solution department.

In the west-central portion of the site, cadmium and zinc appear to originate from the vicinity of the Former Neutralization Pond or an area south of the pond. The Former Neutralization Pond area may have been a greater source of ground water contamination in the past than it is now, as cadmium concentrations are low adjacent to the precipitates, but increase with depth and distance downgradient of the Former Neutralization Pond.

Contamination in the west-central portion of the Plant may also have originated from spent electrolyte solutions that contained high dissolved cadmium and zinc concentrations and may have been disposed on-site in this area of the Plant during the 1930s.

FIGURE 3

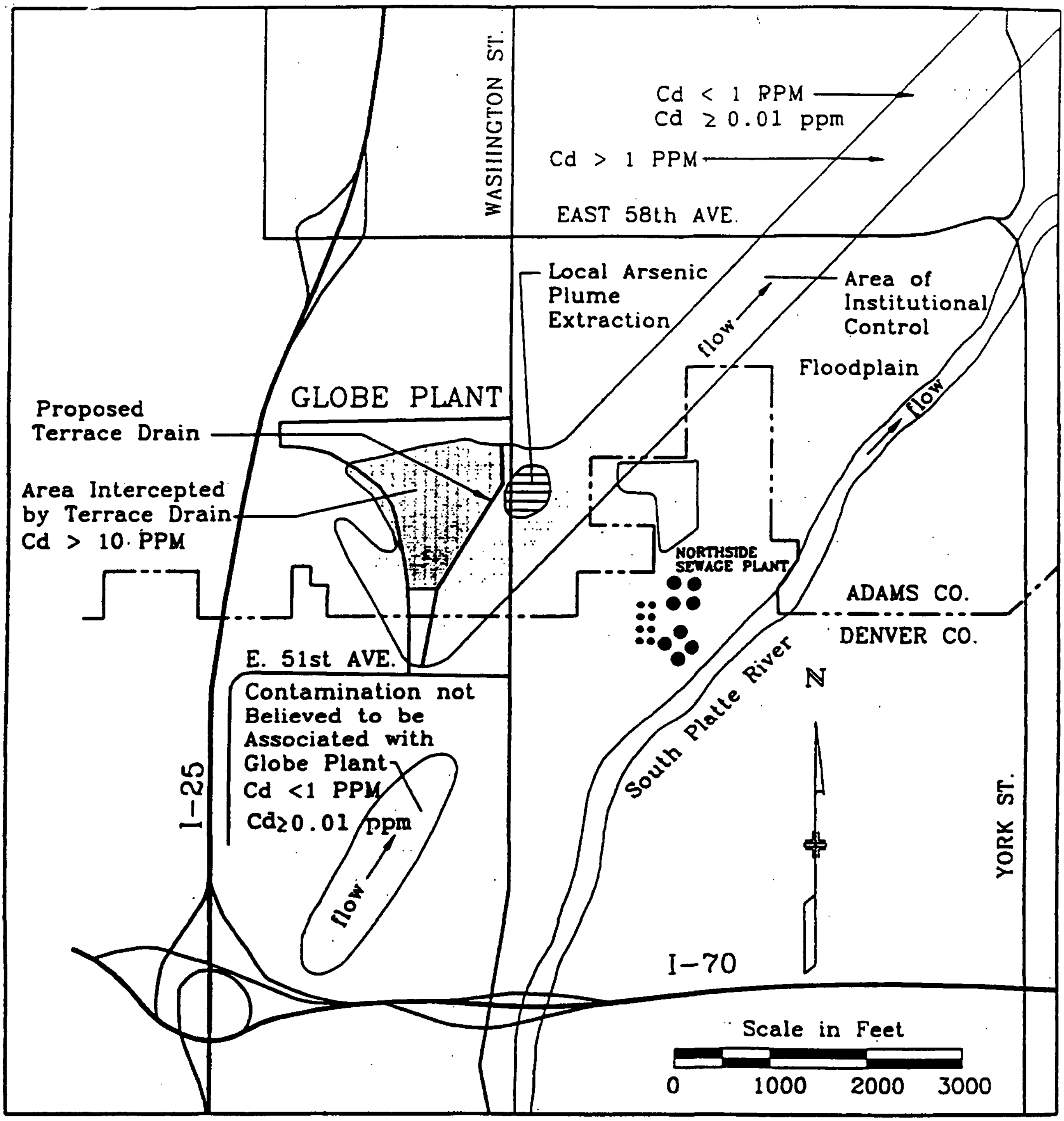


Figure 3 Groundwater Plume Map

The mechanisms that cause attenuation or reduction in the concentration of cadmium and other dissolved constituents in ground water include: 1) dilution due to mixing with other water; 2) dilution due to molecular diffusion of the metal from areas of high concentration to areas of low concentration; 3) precipitation of the metal from the dissolved state to the solid state, due to changes in chemical conditions in the water; and 4) adsorption of positively charged ions to soil and organic particles. While all of these attenuation mechanisms may contribute to the observed decline in cadmium concentrations as the plume moves from the terrace to the floodplain, the majority of the attenuation is due to dilution, caused by dispersion and mixing with background waters in the floodplain.

Arsenic:

High arsenic concentrations in ground water were found principally in the northeast corner of the site along the edge of the terrace. This plume coincides with the location of the former arsenic production facilities that were located there. The facilities may have been the source of arsenic contamination in the area. On-site concentrations of arsenic range from <0.004 mg/l to 127.5 mg/l. The SDWA MCL for arsenic is 0.05 mg/l. The SDWA MCLG for arsenic is also 0.05 mg/l. The maximum observed off-site concentration of arsenic near the eastern boundary of the Plant was 24.0 mg/l. Arsenic concentrations in the floodplain decrease to less than 0.05 mg/l within a few hundred feet of the Plant.

As with the cadmium and zinc plume, the arsenic plume extends southeast to the edge of the terrace. The plume then bends sharply to the northeast following the direction of ground water flow in the floodplain. The extent of arsenic contamination is less than the extent of cadmium contamination shown on Figure 3.

Another localized arsenic plume was detected within and immediately below the precipitate material. This plume does not appear to extend beyond the perimeter of the Former Neutralization Pond.

Surface Water

Impacts to surface water and sediments were evaluated through sampling of surface water and sediment quality in the IDD, the Retention Ponds, the Detention Pond, and the South Platte River. Surface water quality was also evaluated in the FGD water. Table 1 includes the results of the surface water and sediment sampling conducted during the RI.

Seepage of contaminated ground water from the Plant site has increased metal concentrations in surface water and sediments in the IDD and Retention Ponds. Sediments in the Detention Pond also contain elevated levels of the indicator metals. Metal concentrations in the southern portion of the IDD have been reduced due to the partial removal and plugging of an abandoned tile pipe at the Globe Plant that conveyed water from an unknown source to a point near the south end of the ditch.

Sampling and inspections of the FGD revealed that cadmium contaminated ground water was seeping into the pipe where it exits the Plant property. Asarco repaired the pipe in the summers of 1987 and 1988, ultimately reducing cadmium concentrations to below the Colorado stream irrigation standard of 0.01 mg/l. The FGD water downstream of the Plant is used for irrigation of a truck farm and for cooling water at the Cherokee Power Plant.

Releases of metals from the Globe Plant site through ground water and surface water pathways appear to have had little impact on South Platte River water quality. In addition, the mass of metals flowing into the South Platte River per unit of time from different sources shows that the relative contributions of cadmium from the shallow ground water to the river are negligible compared to other sources (TRC 1988). The following contributions of cadmium to the river were estimated (TRC 1988):

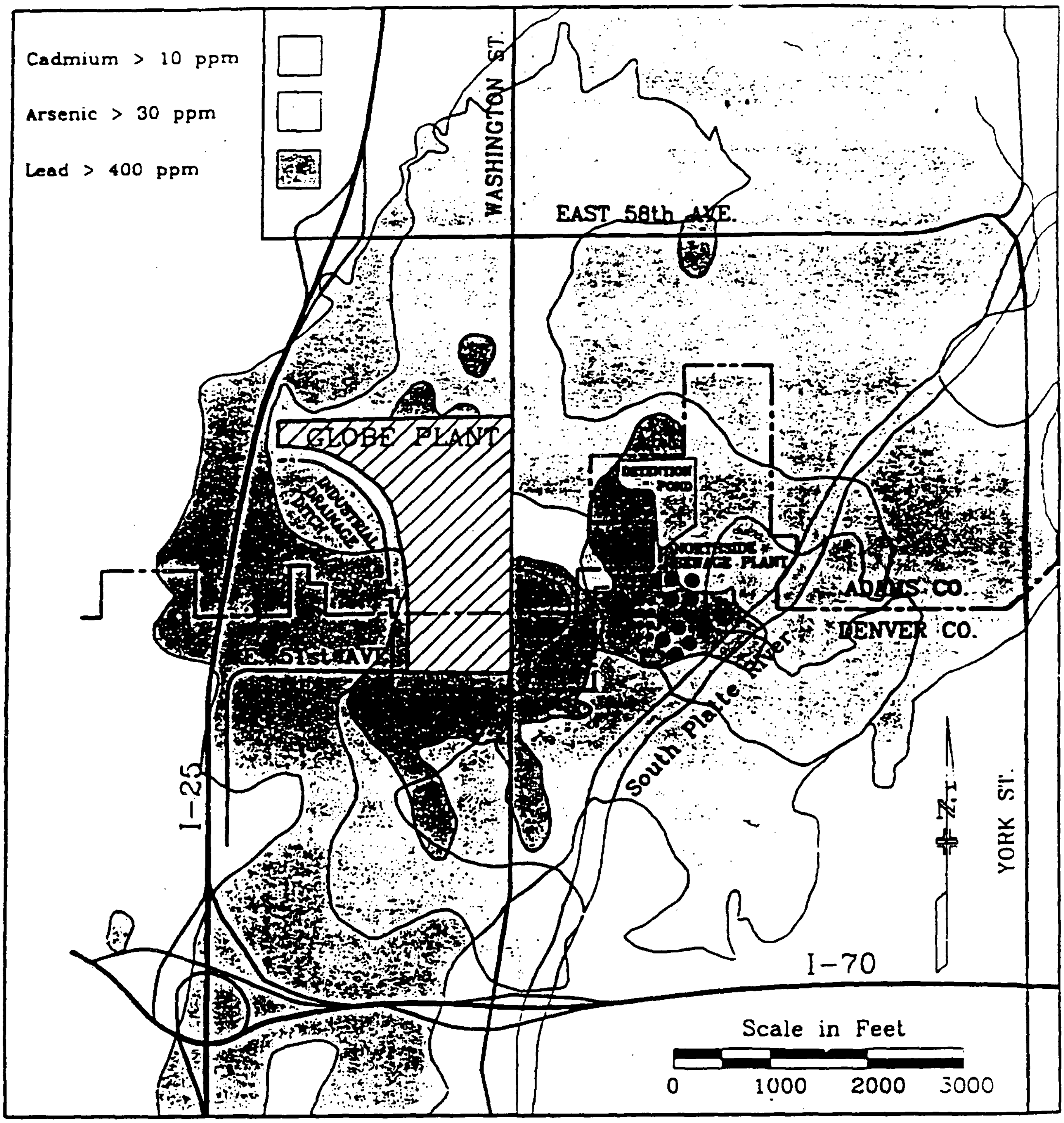
- Background River flow: 591 pounds per year
- Metro Treatment Plant Effluent: 883 pounds per year
- Detention Pond Effluent: 7 pounds per year
- Shallow Ground-Water Plume: 28 pounds per year

Metals concentrations in South Platte River water and sediments are similar upstream and downstream of the Detention Pond outfall and the projected location of the site ground water plume.

Soil

Soil sampling and analyses, in combination with geostatistical contouring techniques, were used to estimate the general extent and magnitude of metals contamination in shallow soils outside the Plant boundary. Cadmium, arsenic, lead, and zinc concentrations exceed background levels in on-site and off-site shallow soils. Elevated metals concentrations in off-site soils are generally due to deposition of airborne particulates from the Globe Plant site. Elevated metals concentrations in the shallow soils on-site are also due to direct mixing with process materials and contact with contaminated run-off water. Metal concentrations in the soil drop off exponentially with distance from the Plant. Figure 4 shows the lateral extent of soil areas where concentrations of the metals of concern exceed the upper limit of background levels.

FIGURE 4



Results of RI and FS Soil Investigations

RI results show that elevated metals concentrations generally decrease with depth. Elevated concentrations of metals in Plant soils are typically confined to the upper 1 or 2 feet in undisturbed soil. Elevated metal concentrations are found at depths of several feet in the fill material in the former sedimentation pond in the northeast corner of the site. In general, the extent of elevated cadmium concentrations is greater than the extent of elevated lead, arsenic, and zinc concentrations.

Concentrations of the metals of concern cover a wide range in off-site soils. Cadmium concentrations outside the Plant boundaries range from 1 ppm to 510 ppm, while concentrations on Plant property ranged from 2 ppm to 9,900 ppm. The cadmium concentration of 8 ppm has been determined to be the upper limit for background concentrations in the Globe Plant area. Arsenic concentrations ranged from 3.7 ppm to 404 ppm outside the Plant boundary, while Plant concentrations ranged from 7.5 ppm to 6,770 ppm. The arsenic concentration of 28 ppm has been determined to be the upper limit for background in the site area. Lead concentrations outside the Plant boundary ranged from 20 ppm to 5805 ppm. Lead concentrations at the Plant ranged from 35 ppm to 16,000 ppm. An upper limit for lead background concentration of 413 ppm was determined. Zinc concentrations outside the Plant boundary ranged from 65 ppm to 2050 ppm; Plant concentrations ranged from 65 ppm to 107,500 ppm. The upper limit of background for zinc has been determined to be 280 ppm. Table 1 includes the results of the soil sampling efforts during the RI.

Vegetable Gardens

The extent of metals contamination in vegetable gardens was evaluated by sampling and analyzing both vegetable garden soils and garden vegetables, as discussed below. Table 1 includes the results of the vegetable garden investigations conducted during the RI.

Vegetable Garden Soils:

Concentrations of cadmium, lead, arsenic, and zinc are typically elevated in vegetable garden soils within one mile of the Globe Plant, compared to the range of normal values reported in the literature and compared to concentrations in vegetable gardens located beyond one mile but within two miles of the Plant. More than 75 percent of vegetable garden soil samples within one mile of the Plant had cadmium concentrations that could potentially affect Plant growth (e.g., may result in reduced yield), compared to 30 percent of the soil samples in the one to two mile zone and none of the soil samples in vegetable gardens beyond a two-mile distance.

The distributions of elevated lead and zinc concentrations in vegetable garden soils were similar to cadmium. Arsenic was elevated (could potentially affect Plant growth) in one sample within one mile of the Plant, and was also slightly elevated in one of the control vegetable gardens more than two miles from the Plant (TRC 1988).

Garden Vegetables:

Cadmium concentrations in vegetables from vegetable gardens within one mile of the Plant were generally high, although this varied with vegetable type. Leafy vegetables generally had the highest cadmium concentrations in vegetable gardens near the Plant, in vegetable gardens in the one to two mile zone, and in the vegetable gardens located more than two miles away from the Plant (considered the control gardens). Elevated lead and zinc concentrations were found in a small percentage of lettuce samples near the Plant. Zinc concentrations in vegetables from vegetable gardens near the Plant were generally higher than those in the control vegetable gardens. Arsenic values were similar in vegetable gardens near the Plant, vegetable gardens in the one to two mile zone, and in the control vegetable gardens beyond the two mile zone. However, values for both control vegetable gardens and those near the Plant are higher than the normal literature values.

Air

Evaluation of air impacts was conducted through air quality sampling at four Asarco sites and three CDH sites located in the Globeville area; installation and data collection from an on-site meteorological tower; and modelling of projected contaminant dispersion.

The results of the air quality monitoring program have shown that average lead concentrations at the Globe Plant stations located near or on the Globe Plant property are typically higher than those measured at the CDH control stations located across Denver, although concentrations at both the Asarco stations and CDH control stations are below the federal lead standard of 1.5 ug/m^3 on an annual average. The state lead standard is 1.5 ug/m^3, for a monthly average. Five daily lead samples from January 1988, when averaged together, indicated that the state standard could have been exceeded at one Asarco monitoring station. The Colorado regulation regarding lead states that compliance is assessed by means of dispersion modelling of source emissions. Dispersion modelling, as conducted in the Feasibility Study, did not indicate a violation, when emissions were averaged over the full 31-day month. In the fall of 1989, Asarco installed an additional baghouse on its litharge (lead oxide) operation. After the installation of this additional control device, lead levels in neighborhood ambient air decreased significantly. The 24-hour Total Suspended Particulates (TSP) primary standard was exceeded at all Colorado Department of Health control stations across the Denver metropolitan area and at the Asarco stations more than once per year (one exceedance is allowed per year).

There are no ambient air standards for cadmium or arsenic. Concentrations of these metals were higher at the Globe Plant stations than at CDH control stations. Analysis of ambient air statistics for cadmium, as provided in the nationwide computer database maintained by EPA, indicates that the levels reported in the vicinity of the Globe Plant are among the highest in the United States.

SUMMARY OF SITE RISKS

Human Health Risks

The Public Health Evaluation (PHE) was conducted as part of the RI/FS to characterize the current or potential threat to human health and the environment that may be posed by the contamination at the site if no remedial actions were to occur. Risk estimates were calculated based on the concentrations of contaminants found at the site. The methodology used in the PHE to estimate risks is also used to determine levels of contaminants that can remain on-site and still be protective of human health. Exposure scenarios were evaluated in conjunction with the contaminants identified to calculate baseline risk values. The calculated risks are estimates of the average and maximum values that could potentially occur, above the background probability of risk (i.e., risk of developing cancer if no exposure to site-related contaminants occurred).

The four components of the risk assessment process include identification of contaminants of concern, exposure assessment, toxicity assessment, and risk characterization. These steps are discussed further below.

Contaminants of Concern

The PHE summarizes the chemical contaminants found in various media (air, soil, sediments, surface water, ground water and garden vegetables) during the course of sampling conducted as part of the RI. Chemicals to be carried through the risk assessment process were selected based on their toxicity and the concentrations present at the site. Arsenic, cadmium, zinc, and lead were found in elevated concentrations over a large geographic area, with concentrations generally decreasing with distance from the Plant site. These metals have been the major contaminants contributing to exposure.

Concentrations of the contaminants of concern in the various media are summarized in Table 1.

Exposure Assessment

In this step, the various ways people in the vicinity of the site could potentially be exposed to the selected contaminants of concern are determined. Exposure pathways examined for the Globe site include inhaling of ambient air, drinking the ground water, eating vegetables grown in the soil, inhaling blowing soil, ingesting contaminated soil, ingesting IDD sediments, and dermal absorption of IDD water. Estimates of the doses of contaminants that could be taken in by humans are then calculated, based upon estimates of factors such as frequency and duration of exposure, contaminant concentration, and absorption for each pathway. Factors used for quantifying exposure are included in the PHE.

Toxicity Assessment

A toxicity assessment involves assessing the potential for each contaminant of concern to cause adverse effects in exposed individuals. For many common toxic substances, this step has been performed and is documented in EPA's Integrated Risk Information System (IRIS) and Health Effects Assessments. Health Effects Assessments have been performed for cadmium, arsenic, lead, and zinc for use at any site where these contaminants are present. A literature search was also conducted to assess the toxicity of the contaminants of concern. More detailed information can be found in the PHE. The information below summarizes the results of the Health Effects Assessments and is not based upon Asarco Globe site-related health information.

The health effects investigated can be carcinogenic (cancer causing) or non-carcinogenic (systemic toxicants). The toxicity assessment also examines the relationship between the level of exposure (dose) and the occurrence of an adverse health effect, which is called the dose-response relationship. A chemical may not cause an adverse or toxic effect unless an individual comes into contact with a particular chemical above a specific dose level for a long enough period of time to cause an adverse health effect.

Lead:

Lead can cause many symptoms including tiredness, paleness, irritability, loss of appetite, sleep disturbance, behavior change, and abdominal pain. Lead can also cause anemia, and at high doses, it can damage the kidneys. Lead has also been associated with elevated blood pressure. Adverse reproductive effects, such as decreased fertility, have occurred in adults with chronic exposures resulting in blood lead levels over 30 ug/dl. Perhaps of greatest concern is the fact that lead has an impact on the central nervous system. This toxic effect is particularly important for young children whose bodies are growing and developing rapidly. Studies have shown that young children with relatively low blood lead levels may show slowed mental development and behavioral problems. Pregnant women are also a sensitive group because lead will cross the placental barrier to the fetus. Slowed nerve conductance velocity has been observed in occupational groups with an average blood lead level greater than 30 ug/dl. Blood lead concentrations above 10 ug/dl are considered of concern by the Center for Disease Control.

Arsenic:

Acute effects can occur from a single or short-term respiratory or oral exposure to a large amount of arsenic. Symptoms include gastrointestinal disturbance (oral exposure), secondary cardiovascular effects and shock, depending on exposure dose level. There may also be direct toxic effects on the liver, blood-forming organs and the central and peripheral nervous system. These effects, however, are associated with very high concentrations of arsenic that could occur in an occupational setting, but are unlikely to occur in community populations that typically experience long-term exposure to lower levels of contaminants.

Both carcinogenic and noncarcinogenic effects are associated with long-term low level exposures to arsenic. These adverse effects include lung cancer (via inhalation), skin cancer (via ingestion), non-cancerous skin lesions, peripheral nervous system effects and cardiovascular changes. In addition, reanalysis of data gathered from cohorts in previous studies has shown an association between ingestion of inorganic arsenic and internal cancers, including lung, liver, kidney and bladder cancers.

Cadmium:

Short-term or acute effects of oral exposure to cadmium include vomiting and diarrhea. Pneumonitis may develop after inhalation exposure to high concentrations of cadmium. These acute effects would be typical of occupational settings, rather than general population exposures.

Emphysema and other chronic pulmonary effects have been observed after long-term inhalation exposure. Emphysema, however, has not been diagnosed to date in any general population studies of individuals exposed to long-term, low-level environmental cadmium exposure. Other toxic effects from long-term exposure to cadmium include cancer of the lung, kidney and prostate, kidney damage, hypertension and tissue damage to the liver, testes, immune system, nervous system and blood.

The kidney is considered to be the critical organ for chronic cadmium exposure. Cadmium is known to accumulate in the renal cortex of the kidney over time, causing damage to the proximal tubules. Proteinuria can develop as a result of severe kidney damage. This condition is usually irreversible. Damage to the tubules is characterized by low molecular weight proteins being excreted in the urine.

Zinc:

Zinc toxicity from excessive ingestion is uncommon in humans. Toxicities reported at high levels of zinc include skin and eye irritation, growth retardation, hypochronic anemia and defective bone mineralization.

Risk Characterization

In risk characterization, comparisons are made between the contaminant exposure estimates developed for each pathway in the exposure assessment and factors developed for each contaminant that quantify the toxicity or carcinogenic potential of that contaminant, developed in the toxicity assessment. Carcinogenic risk is presented in the form of a probability (i.e., the increased chance of contracting cancer that is attributable to the site). CERCLA regulations establish an acceptable risk range of 10^{-4} to 10^{-6} excess cancer cases, with 10^{-6} being the level at which remedial actions are first considered. The state used an acceptable risk range between 1 in 10,000 and 1 in 1,000,000 excess cancer cases, with 1 in 1,000,000 being the level at which remedial actions are first considered, when evaluating risk management decisions.

The PHE also assesses risk to humans of contracting other non-cancerous (systemic) health effects from substances associated with th site. This calculation, called the hazard index, is made for each exposure pathway by dividing the daily human exposure estimate associated with the site by the exposure level that is determined to be without an appreciable risk of causing adverse health effects. Any hazard index that is greater than one is considered unacceptable. This comparison is then used to justify action or inaction.

The draft PHE, released in July, 1989, was prepared during 1988 and 1989 using the Superfund Public Health Evaluation Manual (SPHEM). In December, 1989, EPA issued Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (RAGS). The RAGS manual states that "Issuance of the new manual does not invalidate human health risk assessments completed before (or in progress at) the publication date" (RAGS, p. xv and xvi). As such, the Globe Plant PHE was not redone to conform with current guidance. However, the current risk assessment guidance documents were reviewed and chronic daily intakes, exposure pathways, and resultant estimated risks were calculated using the most recent guidance documents to evaluate any impact to the conclusions of the PHE due to the change of EPA guidance documents. These intakes and estimated risk levels were then compared with those that were included in the PHE. Default values from the RAGS guidance were used for exposure factors, rather than perform a detailed evaluation of whether site-specific factors or more recent literature would support use of alternate exposure factors. In addition, the maximum concentration values were used as the reasonable maximum exposure (RME) concentrations, rather than mathematically evaluating concentration data to determine 95% confidence intervals on concentration values. This results in a more conservative estimate of the RME than use of the 95% confidence interval RME.

A comparison of the calculation of the chronic daily intakes, the air pathway, the drinking water pathway, the home-grown vegetable pathway, and the soil ingestion pathway demonstrates that although there have been changes in both exposure variable values and toxicity values, the resulting hazard quotients (HQ) and excess cancer risks (CA Risk) do not differ significantly between the two methods of guidance. The site contaminants pose risks through several of the exposure routes evaluated. The results of this evaluation are presented in Table 3. This table presents risk estimates from the PHE and risk estimates developed using current RAGS guidance.

TABLE 3 - SUMMARY OF RISK ASSESSMENT RESULTS FOR THE EXPOSURE PATHWAYS FROM THE GLOBE PLANT SITE

EXPOSURE PATHWAY	TOTAL EXCESS LIFETIME CANCER RISK			HAZARD INDEX FOR NONCARCINOGENIC EFFECTS		
	PHE AVERAGE EXPOSURE	PHE MAXIMUM EXPOSURE	RAGS MAXIMUM EXPOSURE	PHE AVERAGE EXPOSURE	PHE MAXIMUM EXPOSURE	RAGS MAXIMUM EXPOSURE
INGESTION OF GROUND WATER CONTAMINATED PLUME	$7.5X10^{-2}$	$5/5X10^{0}$	$2.6X10^{0}$	133	8529	16359
INHALATION OF AMBIENT AIR EAR-SITE AREA	$3.4X10^{-4}$	$4.2X10^{-3}$	$1.2X10^{-3}$	0.26	4.0	NA
INGESTION OF GARDEN VEGETABLES						
ZONE 1	$5.1X10^{-5}$	$2.1X10^{-4}$	$1.6X10^{-4}$	0.20	5.3	2.5
ZONE 2	$2.0X10^{-5}$	$2.1X10^{-4}$	NA	0.03	0.6	NA
INGESTION OF SOIL						
ZONE 1	$2.2X10^{-5}$	$9.2X10^{-3}$	$1.6X10^{-2}$	0.83	273	103
ZONE 2	$1.0X10^{-5}$	$3.2X10^{-5}$	NA	0.57	5.5	NA
INGESTION OF INDUSTRIAL DRAINAGE DITCH SEDIMENT	$5.5X10^{-6}$	$2.7X10^{-5}$	NA	0.34	2.3	NA
ABSORPTION OF INDUSTRIAL DRAINAGE DITCH WATER	$3.9X10^{-8}$	$1.2X10^{-7}$	NA	0.0002	0.002	NA

PHE = Public Health Evaluation (draft July 1989, finalized April 1992).
RAGS = Values calculated using Risk Assessment Guidance for Superfund (EPA, 1989) and presented in the final Asarco Globe Public Health Evaluation (April, 1989).
NA = Not available

Within the contaminated ground water plume, there is an increased risk of cancer and a potential for other non-cancerous adverse health effects if the ground water were to be used as a source of drinking water. Two domestic well use surveys have shown that none of the water within the plume is currently being used for a drinking water supply. Outside of this contaminated plume, the levels of the four chemicals are within drinking water standards.

Ambient air concentrations measured at air monitoring locations near the site were used to estimate risks due to air inhalation. An increased risk of cancer associated with breathing the levels of arsenic and cadmium in the air may exist near the site. The risk estimates are 3.4 excess cancer cases in 10.000 people over a 70 year lifetime of breathing the air for the average case (PHE), 4.2 excess cancer cases in 1000 people for the worst case (PHE), and 1.2 excess cancer cases in 1000 people using RAGS methodologies. Non-cancerous adverse health effects would not be expected for the average case exposure assumptions. However, non-cancerous adverse effects would also be expected in the population near the site assuming maximum exposure conditions. A hazard index of 4.0 was calculated for exposures to lead using PHE methodologies; this calculation could not be repeated with RAGS methodologies because the lead toxicity value for inhalation has been withdrawn.

An increased risk of cancer associated with eating garden vegetables contaminated with arsenic may exist near the site. A risk estimate of 5.1 excess cancer cases in 100,000 people over a 70 year lifetime of eating locally grown vegetables was calculated for those living within one mile of the Globe Plant for the average case (PHE), with 2.1 excess cancer cases in 10,000 people calculated for the worst case (PHE), and 1.6 excess cancer cases in 10,000 estimated using RAGS methodologies. Non-cancerous adverse health effects would not be expected for the average case exposure assumptions. However, non-cancerous adverse effects due to cadmium and lead exposures would be expected in the population living near the site assuming maximum exposure conditions (hazard indices of 5.3 and 2.5 were calculated using PHE and RAGS methodologies, respectively).

Some areas of the community have contaminated soil that has the potential to lead to both non-cancer and cancer health effects if the soil were ingested. The non-carcinogenic risks are of concern principally with regard to children from 1 through 6 years of age, who may ingest soil during play. Carcinogenic risks are due to arsenic exposures. The risk estimates are 2.2 excess cancer cases in 100,000 people over a 70 year lifetime of ingestion of soil for the average case, and 9.2 excess cancer cases in 1000 people for the worst case exposure assumptions using PHE methodologies. Using RAGS methodologies, 1.6 excess cancer cases in 100 people were estimated using worst case exposure conditions. Non-cancerous adverse health effects would not be expected for the average case exposure assumptions. However, non-cancerous adverse effects would be expected in the population near the site assuming maximum exposure conditions for cadmium, lead, and zinc exposures (hazard indices of 273 and 103 were calculated using PHE and RAGS methodologies, respectively).

Children who play in the sediments in the IDD and ingest sediments have increased risk of cancer due to increased exposure to arsenic. The risk estimates for children that play in and ingest sediments are 5.5 extra cancer cases in a population of 1,000,000 for the average case, and 2.7 excess cancer cases in a population of 100,000 for the maximum exposure conditions using PHE assumptions. Non-cancerous adverse health effects would not be expected for the average case exposure assumptions. Non-cancerous adverse effects would be expected in the population near the site assuming maximum exposure conditions (a hazard index of 2.3 was calculated). Because the ditch was fenced, few people are actually exposed to future risk from the IDD sediments. Very little increased risk of cancer exists for children who only have skin exposure to the water in the IDD; 1.2 excess cancer cases in a population of 10,000,000 for the maximum exposure case. Non-cancerous adverse effects would not be expected for either the average or maximum exposure case for exposure to IDD water.

Conclusion

As noted in the text and tables, potential cancer risks from contaminants exceed the acceptable risk range and non-carcinogenic risks exceed a hazard index of one. As part of the process of finalizing the PHE, the current guidance documents were reviewed and risks associated with exposure pathways were re-calculated using the most recent guidance to evaluate any impact to the conclusions of the PHE due to the change in EPA guidance documents through time. This comparison of the calculations demonstrated that although there have been changes in both exposure input values and toxicity values, the resulting hazard quotients and excess cancer risks do not differ significantly between the two methods of guidance. Conclusions regarding whether actions are required are the same.

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD, may pose an imminent and substantial endangerment to public health, welfare, or the environment.

Environmental Risks

Risks to the natural environment were considered in the RI. No threatened or endangered species were observed during the RI field work, or are known to reside on or frequent the site area. No critical wildlife habitat areas were identified as existing at the site. The wildlife and fauna observed were typical to the Denver metropolitan area. Ground water modelling indicated that impacts on the South Platte River from the site, while contributing to the contaminant loading of the river system, are so dilute by the time of impact that effect on the river ecosystem is negligible. No further investigation of environmental risk was conducted.

Uncertainty

An assessment of uncertainty involved in the risk assessment process was performed. The results of this assessment are summarized in Table 4.

TABLE 4

Effect on Risk Assumptions

As a general guideline, assumptions marked as: "low" may affect estimates by less than one order of magnitude, "moderate" may affect between one and two orders of magnitude, and "high" may affect by more than two orders of magnitude.

	Over-Estimate	Under-Estimate	Over- or Under-Estimate
Methods of Sampling and Analysis			
Quantity of samples may restrict total characterization of contamination			Moderate
Failure to account for chemical species in environmental media		Low	
Random errors in analysis resulting from improper quality control			Low
Use of half of the detection value to determine exposure estimates			Low
Estimation of Exposure and Intake Through Each Pathway			
Amount of intake from each pathway is considered to be constant and representative of the general population	Moderate		
Concentration of the metals in the environment remains constant over time			Low
Assumptions used to calculate intake from all sources or exposures within study area in the absence of site-specific data	Moderate		
Standard assumptions of body weight, exposure period, life expectancy, length of residence in area, etc. may not be representative of exposed population			Moderate
Use of maximum concentration in estimating exposures for air, vegetable, soil, and ground water pathways	Moderate		

TABLE 4 - continued

As a general guideline, assumptions marked as: "low" may affect estimates by less than one order of magnitude, "moderate" may affect between one and two orders of magnitude, and "high" may affect by more than two orders of magnitude.

	Over-Estimate	Under-Estimate	Over- or Under-Estimate
Portion of garden vegetables in diet actually consumed			Low
Dermal absorption of metals from all pathways is negligible		Low	
Use of ambient air data collected at Plant boundary to estimate risk outside the Plant boundary	Low		
Toxicological Data			
Derivation of Reference doses or slope factors using animal and limited epidemiological findings, i.e., use of conservative assumptions in extrapolating animal data to human data, high doses to low doses			Low
Reference doses and slope factors of chemicals being assessed are currently under review and may change			Moderate
Toxicological impacts to sensitive population groups is not completely understood		Moderate	
Risks and doses within an exposure route assumed to be additive			Moderate

DESCRIPTION OF ALTERNATIVES

FORMER NEUTRALIZATION POND OPERABLE UNIT

The eight alternatives in the Former Neutralization Pond Operable Unit include no action, periodic monitoring, capping, capping with a slurry wall, excavation with on-site or off-site disposal, and excavation with stabilization prior to on-site or off-site disposal. Two or more alternatives or individual components of alternatives can be combined to achieve the desired remediation. The applicable or relevant and appropriate requirements (ARARs) for the Former Neutralization Pond operable unit alternatives are detailed in Appendix A-4. Estimates of capital costs, annual costs, and present value costs for all Former Neutralization Pond alternatives are presented in Table 5. This table also presents estimated times to implement the Former Neutralization Pond alternatives. The alternatives in this operable unit are described below.

Alternative 1. No Action

The No Action alternative allows conditions identified in the remedial investigation to continue to exist, and risks identified in the PHE to remain. No treatment, containment, or risk reduction is provided. CERCLA regulations require that the no action alternative be evaluated.

Alternative 2. Periodic Monitoring

This alternative involves periodic sampling and analysis of shallow ground water within and proximate to the Former Neutralization Pond and periodic inspections of the existing soil cap. Such a program would monitor changes in conditions with time. No treatment, containment, or risk reduction is provided.

Alternative 3. Single Layer Cap

In this alternative, the Former Neutralization Pond materials would be regraded to form uniform, stable side slopes and proof-rolled prior to installation of a soil cap. The cap would consist of approximately 18 inches of clayey soils, placed over the existing 6-inch thick cap, overlain by vegetated topsoil to prevent erosion. Capping of the materials would provide risk reduction through 1) prevention of human or surface water contact with the materials, 2) prevention of wind-blown particles, 3) minimization of infiltration of precipitation into the materials causing leachate migration into ground water. Waste materials would remain in contact with ground water.

Alternative 4. Multi-Layer Cap

In this alternative, the Former Neutralization Pond materials would be regraded to form uniform, stable slopes and smooth-rolled prior to installation of a layered, composite cap over the materials. The cap would consist of clayey soil and synthetic membrane materials to form a barrier layer, overlain by compacted soil and vegetated topsoil to prevent erosion. Capping of the materials is designed to prevent human contact or surface water runoff contact with the materials and wind-blowing of particles. In addition, the composite cap should prevent or minimize infiltration of precipitation into the materials and minimize leachate migration into ground water. Waste materials would remain in contact with ground water.

Alternative 5. Multi-layer Cap with Slurry Wall and Reversed Ground-Water Gradients

This alternative includes the multi-layer cap of the previous alternative, with the addition of a slurry wall around the Former Neutralization Pond and ground water pumping wells within the slurry wall. The slurry wall would key into the claystone that underlies the alluvial and sandstone deposits. The slurry wall would be approximately 40 feet in depth and would need to penetrate from 0 to 20 feet of sandstone.

Ground water extractions wells would be installed to lower the ground water surface within the slurry wall, thereby creating an inward gradient to prevent outward flow of ground water and subsequent metals migration. Recovered ground water would be treated. The ground water treatment provided by this alternative is essentially the same as identified in Alternative 4 of the Ground Water and Surface Water Operable Unit. Capping of the materials would prevent human contact or surface water runoff contact with the materials and wind-blowing of particles. In addition, the composite cap would prevent or minimize infiltration of precipitation into the materials and minimize precipitation causing leachate migration into ground water. Waste materials would be isolated from the surrounding ground water by the combination of the slurry wall and pumping wells, thus preventing migration of contaminants into the surrounding ground water.

Alternative 6. Excavation of Materials/On-Site Subtitle C Disposal

This alternative consists of excavating and re-disposing the Former Neutralization Pond materials in an on-site double-lined (Subtitle C) landfill in the northwest corner of the site. The landfill would have a double liner, consisting of a lower clay liner with an effective permeability of 10^{-7} cm/s or less and an upper geomembrane liner; leachate collection; and leak detection systems. The landfill would be covered with a multi-layer cap of clayey soil and synthetic membrane materials to form a barrier layer, overlain by compacted soil and vegetated topsoil to minimize erosion. This is the same cap design as described in Alternatives 4 and 5. Containment of the materials through a landfill liner and cap would prevent human contact, prevent surface runoff from contacting the materials, and prevent migration of contaminants into ground water. RCRA land disposal requirements would not be met by this alternative.

Alternative 7. Excavation of Materials/On-Site Stabilization and Subtitle D Disposal

In this alternative, the Former Neutralization Pond materials are excavated, stabilized by mixing with a chemical fixation agent to render the materials non-hazardous, and re-disposed in an on-site solid waste (Subtitle D) landfill. The landfill would be capped with a single barrier layer of clayey soil having an effective permeability of 10^{-6} cm/s or less, overlain by vegetated topsoil to minimize erosion. Field treatability studies conducted during remedial design to determine the optimum mix for stabilization of the materials. Containment of the materials through stabilization and disposal in a landfill would prevent human contact, prevent surface runoff from contacting the materials, and prevent migration of contaminants into ground water.

Alternative 8. Excavation of Materials/Stabilization and Off-Site Disposal

This alternative consists of excavating and stabilizing the Former Neutralization Pond materials to render the materials non-hazardous, with subsequent transportation and disposal at an off-site facility. Although the materials would be rendered non-hazardous through mixing with chemical reagents, disposal at an industrial or hazardous waste facility will still be necessary as it is highly unlikely that a solid waste facility would accept the materials even after stabilization. Field treatability studies would be conducted during remedial design to determine the optimal reagent mix for stabilization. The results of bench tests indicate that stabilization of the Former Neutralization Pond materials is possible. Containment of the materials through stabilization and disposal in a landfill would prevent human contact, prevent surface runoff from contacting the materials, and prevent migration of contaminants into ground water.

TABLE 5

SUMMARY OF ESTIMATED COSTS AND TIMES
FORMER NEUTRALIZATION POND

Alternative	Total Capital Costs	Total Annual Costs	Total Present Costs	Time To Implement
1. No Action	-0-	-0-	-0-	0 years
2. Periodic Monitoring	$ 27,000	$ 28,000	$ 332,000	3 month
3. Single Layer Cap	$ 584,000	$ 30,000	$ 938,000	9 months
4. Multi-Layer Cap	$ 1,528,000	$ 28,000	$ 1,860,000	18 months
5. Multi-Layer Cap, Slurry Wall & Reversed Groundwater Gradient	$ 3,214,000	$ 163,000	$ 5,020,000	2 years
6. Excavation of Materials/On-Site Subtitle C Disposal	$ 8,640,000	$ 100,000	$ 9,761,000	2 years
7. Excavation of Materials/On-Site Stabilization and Subtitle D Disposal	$19,138,000	$ 31,500	$19,508,000	2 years
8. Excavation of Materials/On-Site Stabilization and Off-Site Disposal	$32,740,000	$ 1,000	$32,752,000	2 years

1. Includes first year monitoring costs.

GROUND WATER AND SURFACE WATER OPERABLE UNIT

Ten alternatives have been identified in the Ground Water and Surface Water Operable Unit. These alternatives involve a range of actions to mitigate exposure to metals in the shallow ground water, the IDD System, detention pond, and the Farmers and Gardeners Ditch. The alternatives include no action, one alternative involving periodic monitoring, one alternative involving prevention of human exposure only, six involving varying degrees of collection, disposal, and treatment of ground water, and one involving dredging of the detention pond at the Northside Sewage Treatment Plant. Two or more alternatives or components of alternatives can be combined to achieve the desired remediation. The applicable or relevant and appropriate requirements (ARARs) for the ground water and surface water alternatives are detailed in Appendix A-1. The estimated capital costs, annual operation and maintenance costs, and total present value costs are presented in Table 6. This table also estimates time to implement the ground water and surface water alternatives. The final alternatives are described below.

Alternative 1. No Action

The No Action alternative allows conditions identified in the RI to continue to exist, as well as associated health risks identified in the PHE. No treatment, containment, or risk reduction would be provided by this alternative. Since no actions would be taken, no time would be necessary to implement this alternative. CERCLA regulations require that no action be evaluated as a remedial alternative.

Alternative 2. Periodic Monitoring

This alternative involves periodic sampling and analysis of shallow ground water, IDD water, and FGD water. Such a program would monitor any changes in water quality. No treatment, containment, or risk reduction would be provided by this alternative.

Alternative 3. Prevent Direct Contact

This alternative includes measures that are intended to prevent direct human contact with metals contaminated water and sediment. Institutional controls discouraging or prohibiting the use of and contact with metals-contaminated ground water would be implemented for the shallow ground water in the area. This includes well permit prohibitions within the contaminated plume instituted through the State Engineer's Office. The fence around the IDD would be maintained or modified as necessary to preclude access to the entire length of the ditch. The FGD pipe would be sliplined with a continuous, polymeric liner along the entire segment where contaminated ground water has seeped into the existing pipe. No treatment would be provided by this alternative. Risk reduction would be achieved through prevention of ground water use through institutional controls. Some risk reduction would be achieved through sliplining the

FGD pipe, thereby ensuring that FGD water would not be contaminated by ground water seepage.

Alternative 4. Terrace Drain/Continuous IDD Pipeline

This alternative prevents or minimizes the discharge and migration of metals-contaminated ground water from the site and resultant impacts on the IDD and FGD water. The alternative includes collection and treatment measures as identified below.

Shallow ground water would be collected in a subsurface drain approximately 2100 feet in length, located along the length of the terrace at the Plant, and pumped to the existing Plant wastewater treatment Plant. The drain would cut off shallow contaminated ground water flow in the sandstone and alluvial deposits on the terrace and would be excavated into the top of the underlying claystone bedrock. The drain would prevent further contamination of the floodplain shallow aquifer. Terrace ground water would achieve MCLs in approximately 30 years and floodplain ground water would achieve MCLs in approximately 100 years. Risk reduction would be achieved through prevention of ground water use through institutional controls and would be provided by long-term restoration of terrace and floodplain ground water.

Collected ground water would be treated as necessary at the Plant wastewater treatment Plant and discharged to 1) the sanitary sewer under Asarco's existing wastewater treatment permit (treatment and volumes must meet existing permit requirements); 2) surface water per CoPDES permit requirements; or 3) through underground injection (treatment would meet MCLs). The existing Plant treatment Plant has sufficient capacity to treat collected ground water.

In the IDD, a continuous length of "leak-proof" pipe, such as polyethylene or fiberglass pipe, would be installed and backfilled in the ditch without removal of sediments. Alternatively, the pipeline could be installed in a new trench adjacent to the IDD, which would be backfilled. Some risk reductions would be achieved through prevention of contamination of the IDD water and through minimizing the potential for contact with contaminated IDD sediments.

Alternative 5. Terrace and Interceptor Trench Drains/Concrete Pipeline

This alternative is similar to the previous alternative, except that shallow ground water would be collected on-site in two subsurface drains, one along the terrace escarpment, as described above, and one in the existing Interceptor Trench. Handling of collected ground water, floodplain institutional controls, and a monitoring program would be instituted as described in Alternative 4. Treatment provided, containment, and risk reduction elements are similar to that described in Alternative 4.

The purpose of the second subsurface drain, installed in the existing Interceptor Trench, is to lower the ground water table as necessary to prevent further migration of metals-contaminated ground water into the IDD. Therefore, a conventional precast concrete sewer pipe, rather than a "leak-proof" pipe, could be installed in the IDD. Alternatively, the concrete sewer pipe could be installed in a new trench adjacent to the IDD, which would be backfilled. In either case, the existing IDD sediments would be covered by approximately 4 feet of clayey backfill material to prevent contact with humans or surface waters. The economy of using a less expensive concrete pipe instead of a "leak-proof" pipe is compared to the costs of installing the Interceptor Trench drain and additional water treatment over time in the cost analysis.

Alternative 6. Terrace and Interceptor Trench Drains/Soil Lined Ditch

This alternative includes the same collection, treatment, and monitoring measures as identified in alternatives 4 and 5. The major difference between alternative 5 and this alternative is that this alternative involves the removal of IDD sediments and placement of clean borrow soils, rather than a pipe, in the ditch. As in alternative 5, dewatering of the Interceptor Trench drain will prevent discharge of metals-contaminated ground water to the IDD. Additional risk reduction is provided through removal of the IDD sediments.

Alternative 7. Drain(s)/Slurry Wall

This alternative consists of any of the previous three alternatives with the addition of a slurry wall along the north boundary of the site. The purpose of the slurry wall is to cut off shallow sandstone and alluvial ground water flow upgradient of the site to reduce contamination of clean ground water and reduce the quantity of water requiring treatment. This alternative would include the same collection, treatment, and monitoring measures as identified for the previous alternatives. Risk reductions would also be similar to the previous alternatives.

Alternative 8. Drain(s)/Localized Ground Water Extraction

This alternative consists of any one of the previous four alternatives with the addition of local recovery of highly contaminated ground water in the southwest portion of the Plant, using a system of ground water extraction wells. The objective of the extraction wells is to accelerate the remediation process and, potentially, reduce the overall cost associated with treatment of contaminated ground water. By early extraction of ground water from highly contaminated areas, metals concentrations in recovered ground water may decrease sooner, resulting in the potential savings in treatment costs. Approximately six wells would be required in the alluvial and sandstone formations, near the old carpenter shop and leaching shed, to intercept local ground water with cadmium concentrations exceeding 50 mg/l. It is not expected that time to achieve ground water restoration would be significantly reduced; terrace ground water would achieve MCLs in approximately 30 years and floodplain ground water would achieve MCLs in approximately 100 years. Little, if any, additional risk reduction would be achieved.

Alternative 9. Terrace Options/Floodplain Extraction and Treatment

This alternative consists of utilizing any of the actions in the terrace area as described in previous alternatives with the addition of extraction of the ground water plume in the floodplain. The objective of the floodplain extraction system is to accelerate remediation of the floodplain compared to the natural flushing process. Terrace ground water would achieve MCLs in approximately 30 years and floodplain ground water would achieve MCLs in approximately 10 years. The time necessary to achieve complete risk reductions in the floodplain would be reduced.

Floodplain extraction systems would consist of a series of wells placed at intervals throughout the length of the floodplain plume. Extraction of the width of the floodplain plume could be accomplished by pumping an estimated 7 to 35 gallons per minute (gpm) of ground water from one point in the plume (Appendix B). Each well would extract an equivalent flowrate of water to capture the width of the plume. A floodplain extraction system would reduce the time required to remediate the floodplain plume; however, it would also generate large volumes of ground water requiring collection, treatment, and discharge facilities.

Treatment would be accomplished by a separate treatment facility constructed either on the floodplain or at the Globe Plant. The large volumes of water would prohibit use of the on-site treatment plant unless it is expanded. All of the discharge options described in the previous alternatives are available for consideration.

Alternative 10. Detention Pond Dredging and Disposal

This alternative can be implemented in conjunction with any of the remedial action for the terrace floodplain ground-water plume, and augments alternatives addressing IDD sediments. Detention pond dredging involves removal of sediments from the detention pond by hydraulic dredging methods, followed by dewatering and disposal of the sediments. To prevent creating a potential on-site source of organics if on-site disposal is chosen, a double-lined landfill will be necessary. Alternatively, the sediments could be disposed at an off-site disposal facility.

Once excess water is removed from the sediments, they will still be very wet and may need to be stabilized prior to disposal. Accordingly, the alternative includes a lined dewatering pad, stabilization and on-site disposal. The dewatering pad would consist of two cells, allowing processing of dewatered sediments from one cell, while the other cell is being filled with dredged sediments.

Risk reduction is achieved through prevention of contact with the detention pond sediments, although direct contact is likely to occur only if the sediments become exposed.

TABLE 6
SUMMARY OF ESTIMATED COSTS AND TIMES
GROUND WATER AND SURFACE WATER

Alternative	Total Capital Costs	Total Annual Costs	Total Present Value Estimate	Time To Implement
1. No Action	0	0	0	0 time
2. Periodic Monitoring	$ 88,750	$ 79,500	$ 958,000	3 months
3. Prevent Contact Slipline FGD/ Ditch Fencing/ Institutional Controls	$ 170,000	$ 80,000	$ 1,034,000	6 months
4. Terrace Drains/Continuous Pipeline in Ditch	$1,456,000	$ 290,000	$ 4,715,000	18 months
5. Terrace & Interceptor Trench Drains/Concrete Pipeline in Ditch	$1,547,000	$ 322,500	$ 5,163,000	18 months
6. Terrace & Interceptor Trench Drains/Soil Lined Ditch	$1,592,000	$ 322,500	$ 5,207,000	18 months
7. Drain(s) with Slurry Wall (Additional cost of slurry wall with water treatment savings)	$ 878,612	$ (12,000)	$ 749,000	add + 1 6 months
8. Drain(s) with Localized Groundwater Extraction (Additional cost of localized extraction)	$ 252,000	$ 100,000	$ 358,000	add + 6 months
9. Terrace Options/ Floodplain Extraction System (Additional cost of floodplain system)	$6,267,000	$1,898,000	$19,796,000	3 years
10. Detention Pond Dredging	$4,173,000	-0-	$ 4,173,000	1 year

1. Includes first year monitoring costs.

Alt. 7 results in long-term treatment savings for Alts., 4, 5, and 6, so capital costs exceed present value costs.

COMMUNITY SOILS AND VEGETABLE GARDENS OPERABLE UNIT

The alternatives in the Community Soils and Vegetable Gardens Operable Unit include No Action, Institutional Controls, and three alternatives which involve soil remediation. The alternatives involve actions intended to prevent or minimize the direct exposure to metals-contaminated soils. The goal of Alternatives 3 through 5 is to reduce carcinogenic risks to within the target risk range of 10^{-4} to 10^{-6} and to reduce noncarcinogenic risks to health protective levels. Since recommended risk assessment methodologies have been updated since the FS was first published, residual risk levels have been calculated using both PHE and RAGS methodologies.

In addition, it should be noted that for Alternatives 3 through 5, implementation of these alternatives would be contingent upon obtaining the consent of land owners. For all the action alternatives (Alternatives 3 through 5), it is anticipated that additional sampling will be necessary to further refine the area of remediation. Each alternative, in turn, utilizes lower action levels and provides an expanded area of remediation. Component action levels from different alternatives can be combined to achieve the desired remediation. ARARs for the community soils and vegetable gardens operable unit are described in Appendix A-2. Estimated time to implement, capital costs, annual operation and maintenance costs, and present value costs are presented in Table 7. The individual alternatives are described below.

Alternative 1. No Action

The No Action alternative allows conditions identified in the remedial investigation to continue to exist and the risks identified in the PHE to remain. No treatment, containment, or risk reduction would be provided by this alternative. Since no actions would be taken, no time would be necessary for implementation of this alternative. CERCLA regulations require that the no action alternative be evaluated.

Alternative 2. Institutional Actions

This alternative involves the implementation of a public information and awareness program in the Globeville area. The purpose of the program would be to inform persons in the area of practices and procedures that are available to reduce the risk of potential exposure to metals in the soils. These practices will be useful for individuals of all ages but would be especially directed towards parents of young children. These practices include, but are not limited to, thorough washing of home grown vegetables, minimizing barren soil areas by vegetating or paving, washing hands prior to eating, and encouraging children to play in areas which are not barren soil. No treatment or containment is provided by this alternative. Some risk reduction is achieved through use of educational efforts.

Alternative 3

The goal of Alternative 3 is to prevent or minimize exposure to soils with metals concentrations exceeding certain action levels. In Alternative 3, the areas to be remediated are determined using the following health-based action levels:

Arsenic	120 mg/kg
Cadmium	73 mg/kg
Lead	1,000 mg/kg
Zinc	52,560 mg/kg

and in vegetable gardens, including the zinc phytotoxic action level:

Arsenic	120 mg/kg
Cadmium	73 mg/kg
Lead	1,000 mg/kg
Zinc	500 mg/kg

The arsenic action level, 120 mg/kg, is equivalent to a $1x10^{-4}$ excess cancer risk based on PHE methodology, a reduction from the maximum risk due to ingestion of community soil of $9.2x10^{-3}$ calculated in the PHE. Using RAGS methodology, the arsenic action level is equivalent to a $1.3x10^{-4}$ excess cancer risk, a reduction from $1.6x10^{-2}$. The cadmium and zinc action levels are based upon health protective levels (hazard indices of 1 and 0.18 using PHE and RAGS methodologies, respectively), as compared to a maximum hazard indices of 273 and 103 calculated in the PHE and using RAGS, respectively. The lead action level of 1000 mg/kg is based upon EPA's OSWER Directive #9355.4-02, that sets an interim soil cleanup level for total lead at 500 to 1000 mg/kg. In vegetable gardens, the zinc action level of 500 mg/kg is based upon plant phytotoxicity. Risk reductions are achieved through removal or covering of contaminated soils.

The appropriate technologies to consider for remediating soils are common to each of the Alternatives 3, 4, and 5. These technologies include capping, excavation, deep tilling, and exposure controls. The remediation of the soils by capping or barriers includes:

a. Placing 12 inches of clean borrow soil, depending upon site specific conditions, and restoring the surface to its original condition (e.g. grass).
b. Placing 2 inches of asphalt (or an equivalent barrier).
c. Existing surface conditions such as asphalt, concrete, or buildings.
d. Existing trees, shrubs, and bushes which may provide a suitable barrier to minimize exposure to soils.
e. Existing permanent stockpiles, fixed heavy equipment, and other structures or barriers.

In general, a cover of 12 inches of soil is considered to be an adequate barrier. In some instances, where there is assurance that there will be no disturbance of the cover, and that its integrity will be maintained, a thinner cover may be considered. In no cases will a cover less than 6 inches of soil be considered adequate.

Alternatively, soils with metals concentrations exceeding action levels could be excavated. Excavated soils would be replaced with borrow soils. The ground surface would be restored to its original condition after placement of the borrow soils; for example, by placing sod in previously vegetated areas. Excavated soils would be tested to determine hazardous characteristics. If considered a characteristic hazardous waste, the soil would be taken to an off-site licensed hazardous waste disposal facility, as appropriate and consistent with RCRA Subtitle C requirements. If the soils are not characterized as hazardous, they would be disposed of in an on- or off-site disposal facility and managed in accordance with suitable regulatory requirements.

Deep tilling generally consists of turning soils over and mixing them with deeper, less contaminated soil. Deep tilling is effective where the depth of contaminated soils is less than the maximum depth of tilling.

Exposure controls involve measures that prevent or minimize the potential, as identified in the PHE, for exposure to soils with metals concentrations exceeding the action levels. Areas where exposure controls may be useful and practical include commercial and industrial areas where access is restricted by fences, Plant security, or other means.

In vegetable gardens with soils having metals concentrations exceeding the garden action levels, the soils would be remediated by either excavation and replacement of up to 18 inches of soil or covering of the garden depending on the grade requirements and the preference of the property owner.

Alternative 4

The goal of Alternative 4 is to prevent or minimize exposure to soils with metals concentrations exceeding action levels to reduce the health risks to acceptable levels. In Alternative 4, the areas to be remediated are determined using the following health-based action levels:

Arsenic	120 mg/kg
Cadmium	73 mg/kg
Lead	500 mg/kg
Zinc	52,560 mg/kg

and, in vegetable gardens, including the phytotoxic action level for zinc:

Arsenic	120 mg/kg
Cadmium	73 mg/kg
Lead	500 mg/kg

Zinc	500 mg/kg

The arsenic action level, 120 mg/kg, is equivalent to a $1x10^{-4}$ excess cancer risk based on PHE methodology, a reduction from the maximum risk due to ingestion of community soil of $9.2x10^{-3}$ calculated in the PHE. Using RAGS methodology, the arsenic action level is equivalent to a $1.3x10^{-4}$ excess cancer risk, a reduction from $1.6x10^{-2}$. The cadmium and zinc action levels are based upon health protective levels (hazard indices of 1 and 0.18 using PHE and RAGS methodologies, respectively), as compared to a maximum hazard indices of 273 and 103 calculated in the PHE and using RAGS, respectively. The lead action level of 500 mg/kg is based upon EPA's OSWER Directive #9355.4-02, that sets an interim soil cleanup level for total lead at 500 to 1000 ppm. The lead action level is more conservative than for Alternative 3 and increases the area to be remediated and the risk reduction achieved. In vegetable gardens, the zinc action level of 500 mg/kg is based upon plant phytotoxicity. Risk reductions are achieved through removal or covering of contaminated soils.

The technologies, management, treatment or containment, and ARARs for remediating soils in Alternative 4 are the same as those described in Alternative 3.

Alternative 5

The goal of Alternative 5 is also to prevent or minimize exposure to soils with metals concentrations exceeding action levels to reduce the health risks to acceptable levels. In Alternative 5, the areas to be remediated are determined using the following health based action levels:

Arsenic	28 mg/kg
Cadmium	73 mg/kg
Lead	413 mg/kg
Zinc	52,560 mg/kg

and, in vegetable gardens, including the zinc phytotoxic action level:

Arsenic	28 mg/kg
Cadmium	73 mg/kg
Lead	413 mg/kg
Zinc	500 mg/kg

In Alternative 5, the arsenic action level, 28 mg/kg, is equivalent to a $2.4x10^{-5}$ excess cancer risk using PHE methodology, a reduction from the maximum risk due to ingestion of community soil of $9.2x10^{-3}$ calculated in the PHE. Using RAGS methodology, the arsenic action level is equivalent to a $3.0x10^{-5}$ excess cancer risk, a reduction from $1.6x10^{-2}$. In Alternative 5, health risks due to exposure to soils with elevated metals concentrations are reduced such that the hazard indices representing noncarcinogenic health risks due to cadmium are less than 1.0 using PHE methodologies, and 0.18 using RAGS methodologies, as compared to a maximum hazard index of 273 calculated in the PHE. The lead action level is equivalent to the upper limit of background as developed in the RI, and is more conservative than EPA OSWER Directive 9355.4-02. The arsenic and lead action levels are more conservative than either Alternative 3 or 4 and increase the area to be remediated and the risk reductions achieved. In vegetable gardens, the zinc action level of 500 mg/kg is based upon plant phytotoxicity. Risk reductions are achieved through removal or covering of contaminated soils.

The technologies, management, treatment or containment, and ARARs for remediating soils in Alternative 5 are the same as those described in Alternative 3.

TABLE 7
SUMMARY OF ESTIMATED COSTS AND TIMES
COMMUNITY SOILS AND VEGETABLE GARDENS

Alternative	Total Capital Costs	Total Annual Costs	Total Present Value	Time To Implement
1. No Action	0	0	0	0 time
2. Institutional Actions	$ 12,400	$3,700	$ 53,000	6 months
3. (Residential and Indust. areas; Pb = 1000 mg/kg, Cd = 73 mg/kg, As = 120 mg/kg)	$ 4,733,000	0	$ 4,733,000	2 years
4. (Residential and Indust. areas; Pb = 500 mg/kg, Cd = 73 mg/kg, As = 120 mg/kg)	$ 6,519,000	0	$ 6,519,000	3 years
5. (Residential and Indust. areas; Pb = 413 mg/kg, Cd = 73 mg/kg, As - 28 mg/kg)	$38,872,000	0	$38,872,000	5+ years

PLANT SITE FACILITIES AND SOILS OPERABLE UNIT

Eight alternatives have been identified in the Globe Plant Operable Unit. These alternatives involve actions to prevent or minimize direct exposure to and migration of metals from: 1) surface soils on the Plant site, 2) sediments below the ground water table in the former sedimentation pond ^nd 51st Avenue retention ponds, 3) point source and fugitive air emissions, and 4) solutions in buildings associated with on-going wet operations at the Globe Plant. The sediments in the 51st Avenue retention pond are included in this operable unit, rather than the Ground Water and Surface Water Operable Unit, because it may be practical to manage these sediments in the same manner as those in the former sedimentation pond.

Two or more alternatives of components of different alternatives can be combined to achieve the desired remediation. ARARs for the Plant site soils, sediments and facilities operable unit are described in Appendix A-3. Estimated times to implement, capital costs, annual operation and maintenance costs, and present value costs are presented in Table 8 for Plant Sediments, Soils and Facilities. Table 8A includes these costs and times for the Air Emission Control alternatives and options of this operable unit. The Former Neutralization Pond materials are addressed in a separate operable unit.

Alternative 1. No Action

The No Action alternative allows conditions identified in the RI to continue to exist, as well as associated health risks identified in the PHE. No treatment, containment, or risk reduction would be provided by this alternative. Since no actions would be taken, no time would be necessary to implement this alternative.

Alternative 2. Periodic Monitoring

This alternative involves periodic sampling and analysis of ambient air and periodic inspections of existing soil caps, building sumps, drains, and floors. This program would monitor changes in conditions with time. No treatment, containment, or risk reduction would be provided by this alternative.

Alternative 3. Plant-Site Controls/In-Situ Sediment Stabilization

Alternatives 3 through 6 differ only in the way that sediments in the former sedimentation pond and 51st Avenue Retention Ponds are addressed. In Alternative 3, sediments with metals concentrations exceeding the indicator chemical action levels would be chemically fixed and stabilized in place by injecting and mixing a chemical fixation agent with the soils. Metals would be contained within the stabilized material eliminating the risk of migration. The Retention Ponds would be lined with asphalt or a bituminous liner placed over the stabilized materials to prevent direct exposure and erosion. Stabilized sediments in the former sedimentation pond would be capped with clean soil to prevent erosion of the material.

The remaining actions, which address Globe Plant soils, air emissions, and potential leaks from buildings, are contained in each of the Alternatives 3 through 6.

Action levels for Globe Plant site soils are the same as those identified in the Community Soils Operable Unit. Plant site surface soils with metals concentrations exceeding these action levels would be excavated, deep tilled, capped, or vegetated to prevent direct contact and to prevent erosion by wind and surface runoff. Additional topsoil, tilling, or soil additives would be applied in any areas that will not support vegetation such that vegetative cover is provided. Operational areas not conducive to vegetation (e.g., roads) would be paved.

Spills in active areas of the Plant would be controlled by berms and ditches to isolate areas where materials with higher metals concentrations could accidentally spill on the ground from other areas of the site where spills cannot occur. Spills in the Plant operations area, including those collected in existing storm drains, would be conveyed to spill control ponds on the site, sized to accommodate spills during the one in one hundred year storm. The spill control ponds would be of cut and fill construction, with a polymeric and compacted clayey soil composite liner and a protective layer of soil over the liner to allow periodic removal of sediment. In rare situations when pond capacity is reached, excess water will be pumped through the Plant wastewater treatment system and discharged to the sanitary sewer.

Potential spills or leakage of solutions from tanks or sumps and through floors in buildings with wet operations, such as the Solution Department, Sponge Press Room, Tank House, Leaching Department, and Wastewater Treatment Plant would be prevented or minimized by secondary containment for tanks, spill alarms, overflow prevention controls, repair and/or lining of floors, floor drainage improvements, and sump lining with acid resistant materials as necessary. A floor and sump inspection program would be designed and implemented to identify any additional repairs and upgrades necessary to prevent leakage or spills.

Risk reductions are provided through covering soils contaminated above action levels and providing vegetation; preventing ground water contamination by stabilizing sediments and providing additional Plant site containment; and controlling spills and surface water runoff with the spill control pond.

<u>Alternative 4. Plant Site Controls/Sediment Excavation and On-Site Disposal</u>

In this alternative, sediments exceeding action levels in the former sedimentation pond and 51st Avenue retention ponds would be excavated and disposed without stabilization in an on-site solid waste (Subtitle D) landfill located in the northeast corner of the site.

Any sediments found to be characteristically hazardous would be managed appropriately with potential disposal at an off-site, licensed, hazardous waste (Subtitle C) landfill. The spill control ponds (described under Alternative 3 and common to each subsequent alternative) would be constructed in the location of the former sedimentation pond, after placement of sufficient borrow material to raise the bottom of the pond above the ground water table.

Alternative 4 actions addressing Globe Plant soils and potential leaks from buildings are the same as those described for Alternative 3.

Risk reductions are provided through covering soils contaminated above action levels and providing vegetation; preventing ground water contamination by stabilizing sediments and providing additional Plant site containment; preventing contact with Retention Pond sediments by removing and landfilling; and controlling spills and surface water runoff with the spill control pond.

Alternative 5. Plant Site Controls/Stabilization and On-Site Disposal of Sediments

This alternative is the same as the previous alternative, except that sediments exceeding action levels in the former sedimentation pond and 51st Avenue retention ponds would be stabilized by chemical fixation prior to disposal in an on-site solid waste (Subtitle D) landfill located in the northeast corner of the site. Treatability studies during remedial design would determine the optimum reagent mix necessary to stabilize the metals in the sediment.

Alternative 5 actions addressing Globe Plant soils and leaks from building are the same as those described for Alternative 3. Risk reductions are similar to those achieved through Alternative 4, with additional prevention of ground water contamination by providing chemical fixation.

Alternative 6. Plant Site Controls/Stabilization and Off-Site Disposal of Sediments

This alternative is the same as the two preceding alternatives, except that sediments exceeding action levels in the former sedimentation pond and 51st Avenue retention ponds would be excavated, stabilized, and disposed in an off-site industrial waste (Subtitle D) landfill.

Alternative 6 actions addressing Globe Plant soils and leaks from buildings are the same as those described for Alternative 3. Risk reductions are similar to those achieved through Alternative 4, with additional prevention of ground water contamination by off-site disposal of sediments.

TABLE 8

SUMMARY OF ESTIMATED COSTS AND TIMES PLANT SEDIMENTS, SOILS AND FACILITIES

Alternative	Total Capital Costs	Total Annual Costs	Total Present Value Estimate	Time To Implement
1. No Action	-0-	-0-	-0-	-0-
2. Periodic Monitoring	$ 53,000	$ 33,000	$ 414,000	6 months
3. Plant Controls/In-Situ Sediment Stabilization	$3,495,000	$ 330,000	$ 938,000	9 months
4. Plant Controls/Sediment Excavation & On-site Disposal	$2,825,000	$ 330,000	$ 6,486,000	1 to 3 years
5. Plant Controls/Sediment Stabilization & Disposal	$3,578,000	$ 330,000	$ 7,238,000	1 to 3 years
6. Plant Controls Stabilization and Off-site Disposal of Sediments	$ 4,710,000	$330,000	$ 8,371,000	1 to 3 years

1. Includes first year monitoring costs.

TABLE 8A

SUMMARY OF ESTIMATED COSTS AND TIMES
PLANT AIR EMISSION CONTROLS

Alternative	Total Capital Costs	Total Annual Costs	Total Present Value Estimate	Time To Implement
7. Point Source Emission Controls (Costs add to Alternatives 3-6)	$1,169,000	$ 29,000	$ 2,165,000	1 year
8. Point Source Emission Controls (Costs add to Alternatives 3-6)	$1,735,000	$ 29,000	$ 2,731,000	1 year
Air Engrg. Design Study Option 1 Venturi Scrubbers Secondary HEPA's	$1,468,000	$ 460,000	$ 5,786,000	2 years
Air Engrg. Design Study Option 2 Ionizing Scrubber, Secondary Scrubbers	$1,940,000	$ 463,000	$ 5,492,000	2 years
Air Engrg. Design Study Option 3 Spray Demister and Baghouse, Secondary HEPAs	$1,328,000	$ 443,000	$ 5,492,000	2 years
Air Engrg. Design Study Option 4 Scrubber, Modified Hopper Secondary HEPAs	$1,187,000	$ 377,000	$ 4,726,000	2 years

1. Includes first year monitoring costs.

Alternatives 7 and 8. Air Emission Source Controls

Alternatives 7 and 8 involve controls to reduce point (i.e. stack) and nonpoint (fugitive) sources of air emissions. These two alternatives augment other remedial actions at the Globe Plant and can be implemented in addition to any of the previous alternatives. The existing point source controls and the potential modifications that were incorporated into Alternatives 7 and 8 are presented in Table 9 (5.6A from the FS). A summary of estimated capital costs, operation and maintenance costs, total present value costs, and estimated time to implement was presented in Table 8A. In developing the point source controls, a review of potential emission control technologies was conducted to determine appropriate technologies for consideration at the Globe Plant. Principle ARARs for emission source control alternatives are presented in Appendix A-3.

Alternative 7

Alternative 7 achieves reductions in emissions from the Globe Plant sources by improving existing point source emission control systems and installing new controls in some areas. Point source emission controls in Alternative 7 include installing emission controls on the leaching department stack that is currently an uncontrolled source; installing a new baghouse in the retort department (DC #4) and changing the bag fabric and type of service of retort DC #2; and changing the bag fabric in the cadmium powder and cadmium oxide packaging baghouses. Additional controls for fugitive emissions from production centers and buildings would be examined as part of the design analysis.

Nonpoint sources of fugitive emissions are primarily associated with surface soils, roadways, and operation of the Globe Plant. These emissions would be minimized by implementing alternative facility practices, as necessary. These practices include altering or eliminating a process component, maintaining negative pressure inside buildings with emissions, keeping doors shut when possible, covering or eliminating any outdoor stockpiles and using vacuum sweepers for roads and building floors. In addition, any inadvertent spills of feedstock and other materials containing metals would be cleaned by washing with recovery of washwater, rather than by sweeping whenever possible. Fugitive emissions from soils and roads would be minimized by vegetating surface soils in open areas and paving roads.

Risk reduction from Alternative 7 is achieved through additional capture of air pollutants emitted from the Plant stacks and from a reduction in fugitive emissions. The FS estimates that these controls would be expected to reduce the maximum risks due to cadmium and arsenic emissions to approximately $9.3x10^{-5}$ excess cancer risk using PHE methodology as compared to a maximum risk of $4.2x10^{-3}$ excess cancer cases calculated in the PHE if no additional actions are taken.

Alternative 8

Alternative 8 represents an increase level of effort over Alternative 7. This alternative includes modifying existing emission control systems through replacement of the cleaning mechanisms. Additional point source controls considered in Alternative 8 include GoreTex bags on the leaching tank stack, premelt/casting department, and the retort production sources; installing emission controls in the purification sponge stack that is currently uncontrolled; and retrofitting the cleaning mechanism from mechanical shaker to pulse air for the cadmium powder (DC #3), cadmium oxide packaging (DC #1), and retort DC #2 baghouses. Fugitive controls for production centers and for nonpoint source areas are described in Alternative 7.

This alternative provides risk reduction through additional capture of point source emissions from the Globe Plant processes and from a reduction in fugitive emissions. The FS estimates that these controls would be expected to reduce the maximum risks due to cadmium and arsenic emissions to approximately $6.5x10^{-5}$ excess cancer risk using PHE methodology as compared to a maximum risk of $4.2x10^{-3}$ excess cancer cases calculated in the PHE if no additional actions are taken.

<u>Additional Air Emission Source Control Alternatives</u>

Although a detailed evaluation of control technologies was used to develop and evaluate Alternatives 7 and 8 of the FS, a more detailed analysis of additional controls and/or changes to Plant production procedures was necessary to determine whether further reduction of emissions could be achieved. This analysis was conducted after the FS and prior to the preparation of the Proposed Plan. The analysis (Air Emission Control Evaluation), prepared by the state's consultant (JACA Corporation, 1992), presents four additional control alternatives that were subsequently evaluated for technical effectiveness, implementability, and associated costs of additional controls and/or changes. Individual components from these alternatives can be selected to provide the desired remediation. Emission control components included in each option are presented in Table 10 (Table 7-1 of the Air Engineering Design Study).

Air Emission Control Option 1 includes a venturi scrubber in the Leaching Department and the Solutions Department and a solution heater. Air Emission Control Option 2 includes an ionizing wet scrubber in the Leaching Department and Solution Department. Air Emission Control Option 3 includes a spray demister and baghouse in these departments. Air Emission Control Option 4 includes a modified charging hopper and baghouse in the Leaching Department and wet scrubber in the Solution Department.

Air Emission Control Options 1 through 4 also include secondary High Efficiency Particulate Air (HEPA filters) at the Premelt and Retort Departments. HEPA filters are designed to efficiently remove contaminant particles by forcing the contaminated air through filtering material. HEPA filters are a promising technology but require pilot testing to determine whether they are feasible and implementable in an industrial process setting such as the Globe Plant.

TABLE 9
TABLE 5.6A of FS
EXISTING CONTROLS AND POTENTIAL MODIFICATIONS
AIR EMISSION POINT SOURCES

Source	"Existing Case" Controls (Cleaning Method, Fabric Types)	Alternative 7 (emission control Option No. 1)	Alternative 8 (emission control Option No. 2)
Leaching Tank Stack	none	Baghouse (Pulse Air, Polyester Felt)	Fabric Selection (GoreTex™)
Premelt/Casting Department	Baghouse (Pulse Air, Acrylic Polyester Felt)	same as existing case	Fabric Selection (GoreTex™)
Purification Sponge Stack	none	none	Control Device[1] (50% Efficiency)
Solution Tanks/ Purification Stack	none	Control Device[1] (50% Efficiency)	Control Device[1] (80% Efficiency)
Retort Production	Baghouse (Pulse Air, Dacron Polyester-Felt)	same as existing case	Fabric Selection (GoreTex™)
Cd Powder (DC#3)	Baghouse (Mechanical, Dacron Polyester-Slick)	Optimize Cleaning Cycle, Fabric Selection (GoreTex™)	Retrofit Cleaning Mechanism (Pulse Air)
CdO Packaging (DC#1)	Baghouse (Mechanical, Dacron Polyester-Slick)	Optimize Cleaning Cycle, Fabric Selection (GoreTex™)	Retrofit Cleaning Mechanism (Pulse Air)

(continued)

Note: (1) For example, mist eliminator, wet scrubber, or baghouse.

TABLE 9 (continued)
TABLE 5.6A of FS
EXISTING CONTROLS AND POTENTIAL MODIFICATIONS
AIR EMISSION POINT SOURCES
(continued)

Source	"Existing Case" Controls (Cleaning Method, Fabric Types)	Alternative 7 (emission control Option No. 1)	Alternative 8 (emission control Option No. 2)
Retort Furnaces (DC#2)	Baghouse (Mechanical, Dacron Polyester-Slick)	Downsize, Change Mode of Service, Fabric Selection (GoreTex™)	Retrofit Cleaning Mechanism (Pulse Air)
		Baghouse (DC#4), (Pulse Air, GoreTex™)	same as alternative 7
Water Treatment Plant	Scrubber (Counter Current, Packed Tower)	Optimize Liquid/ Gas Ratio, Reagent Ratio, Recycle Rate.	same as alternative 7
Litharge DC#1	Baghouse (Mechanical, Dacron Polyester-Slick)	same as existing case	same as existing case
Litharge DC#2	Baghouse (Mechanical, Dacron Polyester-Slick)	same as existing case	same as existing case
Litharge DC#3	Baghouse (Pulse Air, GoreTex™)	same as existing case	same as existing case
Litharge DC#4	Baghouse (Pulse Air, Dacron Polyester-Felt)	same as existing case	same as existing case

TABLE 10

Table 7-1

(from the Air Engineering Design Study)

Air Emission Control Alternatives

Source	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Leaching	Venturi scrubber in stack	Ionizing wet scrubber in stack	Sprayed demister and GoreTex® baghouse in stack	Provide charging hopper with cover, modify for subsurface addition and control with baghouse. No control on reaction and filtration
Solution purification and heating	Fired heater in heating vessel recirculation line, Venturi scrubber in stack	Ionizing wet scrubber in stack	Sprayed demister and GoreTex® baghouse in stack	Venturi scrubber in stack
Sponge production	No controls	No controls	No controls	No controls
Premelt				
Baghouse	Secondary HEPA	Secondary HEPA	Secondary HEPA	Secondary HEPA
Retort				
Baghouses 1&2	Secondary HEPA	Secondary HEPA	Secondary HEPA	Secondary HEPA
D.C. 1	Secondary HEPA	Secondary HEPA	Secondary HEPA	Secondary HEPA
D.C. 2	Secondary HEPA	Secondary HEPA	Secondary HEPA	Secondary HEPA
D.C. 3	Secondary HEPA	Secondary HEPA	Secondary HEPA	Secondary HEPA
D.C. 4	Secondary HEPA	Secondary HEPA	Secondary HEPA	Secondary HEPA

TABLE 10

Estimated costs associated with Options 1, 2, 3, and 4 are presented in Table 11 (Table 7-3 of the Air Engineering Design Study). All of these options provide risk reduction through additional capture of point source emissions from the Globe Plant and through fugitive emission controls. Residual risk estimates associated with implementation of these options range from approximately 1×10^{-5} for option 1, 2×10^{-5} for options 2 and 3, to 3×10^{-5} for option 4. These risk estimates were performed by JACA Corporation using methodologies similar to RAGS.

TABLE 11

Table 7-3 of Air Engineering Design Study
Proposed Control Alternatives
Capital and Annual Costs
1992 Dollars
Maximum Annual Production: 1,305,600 Pounds[a]

	Control Alternatives							
	1		2		3		4	
Department	Total Capital Investment	Total Annual Out-of-Pocket Cost	Total Capital Investment	Total Annual Out-of-Pocket Cost	Total Capital Investment	Total Annual Out-of-Pocket Cost	Total Capital Investment	Total Annual Out-of-Pocket Cost
Leaching	170,200	74,200	570,300	85,000	208,600	74,100	65,000[d]	7,600
Solution	176,300	16,600[c]	384,700	64,000	135,100	55,500	137,000	55,800
	137,000	55,800						
	313,300	72,400						
Premelt	75,600	87,000	75,600	87,600	75,600	87,600	79,600	87,600
Retort								
Baghouse 1	64,000	41,800	64,000	41,800	64,000	41,800	64,000	41,800
Baghouse 2	64,000	41,800	64,000	41,800	64,000	41,800	64,000	41,800
D.C. 1	56,000	15,400	56,000	15,400	56,000	15,400	56,000	15,400
D.C. 2	70,300	19,900	70,300	19,900	70,300	19,900	70,300	19,900
D.C. 3	61,100	27,000	61,100	27,000	64,100	27,000	64,100	27,000
D.C. 4	72,400	80,600	72,400	80,600	72,400	80,600	72,400	80,600
Totals	946,900	460,700	1,417,700	463,100	807,100	443,700	665,400	377,500

[a]Maximum production through premelt is 1,305,600 pounds. Retort department, which can supplement cadmium from Premelt with outside purchases has a maximum annual production of 2,568,000 pounds and Retort costs were calculated at that rate.
[b]Annual out-of-pocket cost is the annual cost less capital recovery. See Appendix A for total annual costs.
[c]Upper line shows the costs of the solution heater; the lower line the costs of the venturi scrubber.

SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 300.430(e)(9) of the NCP requires that the agencies evaluate the remedial cleanup alternatives based on the nine criteria listed below. The first two criteria, overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements, are threshold criteria and must be met by the selected remedy. The next five criteria are considered primary balancing criteria; the agencies must balance between these criteria in order to select the best remedy. It is understood that the selected remedy may not rank highest on every one of the balancing criteria. The remaining two, community acceptance and support agency acceptance, are to be used by the lead agency as modifying factors in the decision-making process. The selected remedy must represent the best overall balance of the selection criteria.

<u>Evaluation and Comparison Criteria</u>

1. <u>Overall protection of human health and the environment</u> addresses whether a remedy provides adequate protection of human health and the environment and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

2. <u>Compliance with applicable or relevant and appropriate requirements (ARARs)</u> addresses whether a remedy will meet all of the requirements of other federal and state environmental laws and regulations or provide grounds for invoking a waiver.

3. <u>Long-term effectiveness and permanence</u> refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

4. <u>Reduction of toxicity, mobility and volume through treatment</u> refers to the degree that the treatment technologies reduce the harmful nature of the contaminants, their ability to move, and/or their volume.

5. <u>Short-term effectiveness</u> addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. <u>Implementability</u> refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to carry out a particular option.

7. <u>Cost</u> includes the estimated capital costs, operation and maintenance costs and present worth costs of each alternative.

8. Support agency acceptance summarizes US EPA comments on the RI/FS and Proposed Plan and considers whether US EPA agrees with or opposes CDH's proposed remedy. For the site, the state (CDH) is the lead management agency.

9. Community acceptance summarizes the public's general response to the alternatives described in the Proposed Plan and the RI/FS. Specific responses to public comments are addressed in the Responsiveness Summary of the ROD.

The following tables present a summary of the evaluation and comparison of alternatives by each operable unit. This evaluation is presented in greater detail in the Feasibility Study. Key points relative to each criteria are described below.

Overall Protection of Human Health and the Environment

This criterion evaluates how the alternatives provide human health and environmental protection. Previous sections of this ROD describe how risks posed through each pathway are reduced, eliminated, or controlled through treatment, engineering controls, or institutional controls. Key points of the comparative analysis are described below. Details are presented in Tables 12A through 12E.

- In all operable units, the no action, periodic monitoring and institutional controls do not achieve this protectiveness criterion.

- For the Former Neutralization Pond Operable Unit (Table 12A), single and multilayer covers (Alternatives 3 and 4) provide limited protection, since materials remain in contact with ground water. Separation from ground water is necessary to adequately achieve this criterion (Alternatives 5, 6, 7 and 8).

- For the Community Soils Operable Unit (Table 12C), Alternative 3, 4, and 5 represent progressively more protective remedies, respectively. Alternatives 3 through 5 achieve a health-protective level for cadmium. Alternative 3 is less protective than Alternative 4 or 5 for lead. Alternative 5 results in the most protective remedy for arsenic.

- For the Ground Water and Surface Water Operable Unit (Table 12B), alternatives involving the terrace ground water drain (Alternatives 4, 5, and 6) achieve cleanup objectives. Optional Alternatives 8 and 9 provide more accelerated cleanup. Alternatives that involve leaving contaminated sediments where potential exposures exist are not protective.

- For the Plant Site Operable Unit, air emission controls that involve reducing carcinogenic risk below the $1x10^{-4}$ excess cancer risk threshold can be considered protective. Additional risk reductions result in increasing levels of protectiveness. Alternative 7 is marginally protective, while Alternative 8 and Options 4, 3, 2, and 1 result in increasing levels of protectiveness, respectively. Reduction to human health risk due to ingestion of Plant site soil and sediments is achieved in each of Alternatives 3 through 6. Control of potential leakage from buildings will prevent additional contamination of on-site ground water.

Compliance with ARARs

ARARs are those cleanup standards, and other substantive requirements or limitations promulgated under federal or state law specifically to address contaminants or remedial actions at a CERCLA site. The state has reserved the right to independently apply any applicable state or federal environmental regulatory authority. These include, but are not limited to, the Colorado Hazardous Waste Management Act, the Resource Conservation and Recovery Act, the Colorado Clean Air Act, the federal Clean Air Act, and their implementing regulations. An evaluation of federal and state ARARs is presented in Appendix A and summarized in Tables 12A-12E. Key points of the comparative analysis are presented below.

- In all operable units, the no action, periodic monitoring and institutional control alternatives do not meet ARARs.

- For the Former Neutralization Pond Operable Unit, remedies that involve capping without separation from ground water (Alternatives 3 and 4) do not meet RCRA Subtitle C landfill closure requirements. On-site Subtitle C disposal without treatment (Alternative 6) would not meet RCRA land disposal requirements. Alternatives 5, 7, and 8 meet ARARs, although the pumping wells in Alternative 5 require maintenance.

- For the Ground Water and Surface Water Operable Unit, all alternatives involving active ground water remediation (Alternatives 4 through 9) meet ARARs, but with varying time-frames.

- For the Community Soils Operable Unit, all excavated materials characterized as TCLP hazardous will be managed in accordance with hazardous waste requirements.

- For the Plant Site Operable Unit, all alternatives involving active remediation also include Plant building leak controls that will meet substantive federal and state requirements. All federal and state air emission standards will be met by all air alternatives.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to the ability of a remedy to maintain reliable protection of human health and the environmental through time. This criterion includes the consideration of residual risk and the adequacy of institutional controls. The comparative analysis of this criterion is made in Table 12A through 12E. Key points are presented below.

- For all operable units, no action and periodic monitoring alternatives provide no long-term effectiveness; institutional controls are considered less effective than engineering controls.

- For the Former Neutralization Pond Operable Unit, covering the materials (Alternatives 3 and 4) will not be as permanent or effective as Alternatives 5 and 6 that involve more complete containment. Alternatives involving treatment (Alternatives 7 and 8) may be more permanent.

- For the Ground Water and Surface Water Operable Unit, all terrace related alternatives (Alternatives 3 through 6) are permanent and effective. All alternatives involve use of institutional controls and result in the same levels of residual risk. For sediments, Alternative 6 involves removal of sediments and is more permanent and effective than those alternatives involving capping alone.

- For the Community Soils Operable Unit, Alternatives 3, 4 and 5 offer similar degrees of effectiveness and permanence; they differ in levels of residual risk and in the increasing areas of remediation.

- For the Plant Site Operable Unit, all Plant building spill remedies offer similar levels of permanence. Long-term effectiveness of in-situ stabilization of sedimentation basin sediments is not well proven. All air emission control alternatives offer similar levels of permanence and long-term effectiveness, using different technologies. Levels of residual risk are lower for Options 1 through 4 than for Alternatives 7 or 8. HEPA filter effectiveness needs to be demonstrated.

<u>Reduction of Toxicity, Mobility, and Volume through Treatment</u>

Congress has expressed a preference under CERCLA for selecting remedial actions that employ treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of hazardous substances as their principal element. Alternatives evaluated relative to this criterion are found in Tables 12A through 12E. Key points are presented below.

- For all operable units, the no action, periodic monitoring, and institutional controls do not reduce the toxicity, mobility, or volume of soil or ground water contaminants.

- For the Former Neutralization Pond Operable Unit, Alternatives 7 and 8 offer reduction of toxicity and mobility through treatment; these alternatives also increase volume. Alternatives involving containment (Alternatives 5 and 6) reduce contaminant mobility. Alternative 5 provides reduction of toxicity, mobility, and volume through ground water treatment.

- For the Community Soils Operable Unit, remediation Alternatives 3, 4, and 5 rely on removal and covering for reduction of mobility.

- The Ground Water and Surface Water Operable Unit provides reduction of volume and toxicity through treatment for the terrace ground water alternatives (4, 5, 6, and 7). Alternative 6 provides toxicity, mobility, and volume reduction for Industrial Drainage Ditch sediments through removal.

- For the Plant Site Operable Unit, sedimentation basin sediment stabilization and off-site disposal (Alternative 6) provides the most reduction of toxicity, mobility, and volume through treatment. Alternative 5, provides reduction of toxicity and mobility through treatment by stabilization of sediments with on-site disposal. All point source emission controls (Alternatives 7 and 8 and Air Engineering Design Study Options 1 through 4) reduce toxicity, mobility, and volume through treatment.

Short-Term Effectiveness

Short-term effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the implementation of the remedy. Short-term effectiveness for each alternative is evaluated in Tables 12A through 12E. Key points are presented below.

- For the Former Neutralization Pond Operable Unit, alternatives that involve excavation and transportation (Alternatives 6, 7, and 8) are less favored because of the potential for short-term release and migration of precipitate dust during the 2-year implementation period.

- For the Ground Water and Surface Water Operable Unit ground water remedies, short-term exposures will be minimized through institutional actions. Implementation time is the same for each alternative.

- For the Community Soil Operable Unit, all community soil remediation alternatives include removal and disposal of soils that may present exposures during excavation and transportation of materials. Both short-term exposure risks and implementation time increase with increasing area of remediation.

- For the Plant Site Operable Unit, in-situ stabilization of the sedimentation basin (Alternative 3) is favored due to less short-term risks than excavation and disposal options (Alternatives 4, 5, and 6). In addition, alternative 6 involves off-site transportation; increasing short-term risk compared to on-site remedial actions. HEPA filter effectiveness needs to be demonstrated.

Implementability

Implementability refers to the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the remedy. This criterion is evaluated in Tables 12A through 12E. Key points are presented below.

- For the Former Neutralization Pond Operable Unit, containment alternatives (Alternatives 3, 4, and 5) are favored due to shorter implementation time and conventional construction procedures relative to alternatives involving excavation, stabilization, and/or off-site transportation (Alternatives 6, 7, and 8).

- For the Ground Water and Surface Water Operable Unit, ground water removal/treatment technologies and Industrial Drainage Ditch remediation technologies are demonstrated and available (Alternatives 4, 5, 6, 7, and 10). The ability of ground water pumping systems (Alternatives 8 and 9) to achieve MCLs has been questioned.

- For the Community Soils Operable Unit, while the technologies are the same and are easily implemented for each alternative, larger areas to remediate would require increasing levels of administrative coordination.

- For the Plant Site Operable Unit, all alternatives are implementable except that in-situ stabilization of sediments (Alternative 3) may not be technically feasible. For point source air emission controls, all alternatives are implementable except that secondary HEPA filters will require pilot tests to determine implementability (Options 1 through 4).

Cost

This criterion evaluates the estimated costs of each remedial alternative. For comparison, capital and annual operation and maintenance costs were used to calculate a present worth cost for each alternative. These are presented in Tables 12A through 12E.

Costs usually increased with overall complexity of the remedy. In general, the benefits of higher cost remedial alternatives are weighed against short-term exposure risks due to implementation, long-term residual risks, and feasibility or implementation constraints. Costs for off-site disposal of wastes can vary significantly.

For the community soils and Vegetable Gardens Operable Unit, the relative costs of alternatives represent increasingly larger areas requiring remedial action. This increasing cost is commensurate with progressively lower cleanup levels.

Support Agency Acceptance

The Colorado Department of Health has been the lead agency for the development of this Record of Decision and has selected the remedy contained herein. The US EPA has reviewed and commented on the RI/FS documents and Proposed Plan. The US EPA comments on the Proposed Plan are generally supportive and are included in the Responsiveness Summary of this ROD.

Community Acceptance

Numerous comments were received on the Proposed Plan. These comments are responded to in the Responsiveness Summary Section of the ROD. While some commentors urged that more extensive and costly actions be taken, others argued that no actions were necessary or proposed actions were too extensive. In general, community concerns focused around the protectiveness of the community soil action levels, medical monitoring issues, and the need for additional levels of protection from Plant site air emissions. These issues are addressed in the Responsiveness Summary.

Table 12A. Comparative Analysis of Alternatives - Former Neutralization Pond Operable Unit.

Criteria	(1) No Action	(2) Periodic Monitoring	(3) Single Layer Cover
1. Overall protection of human health and the environment	Present cover is not sufficient to prevent direct contact or migration of materials in the long-term.	Present cover is not sufficient to prevent direct contact or migration of materials in the long-term.	Provides limited protection with cover. Materials remain in contact with ground water.
2. Compliance with ARARs	Would not be achieved	Would not be achieved	Ability to achieve unlikely as long as materials are potentially in contact with ground water.
3. Long-term effectiveness and permanence	Present cover is not sufficient to contain the materials or minimize erosion, or prevent ground water contamination.	Present cover is not sufficient to contain the materials or minimize erosion, or prevent ground water contamination.	In-place cover not as effective and permanent as full containment. Materials remain in contact with ground water.
4. Reduction of toxicity, mobility, or volume through treatment	No reduction in toxicity, mobility, and volume.	No reduction in toxicity, mobility, and volume.	Cover will provide some reduction of mobility by minimizing infiltration.
5. Short-term effectiveness	Present cover has been effective in short-term minimization of wind-blown particulates.	Present cover has been effective in short-term minimization of wind-blown particulates. Also, no additional risk due to implementation.	Limited risks to public and workers to implement.
6.Implement-ability	No action is easy to implement.	Periodic monitoring readily implemented.	Short implementation time. Conventional construction procedures.
7. Cost	$0	$330,000	$940,000
8. Support Agency Acceptance	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept no action.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept periodic monitoring alone.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept.
9. Community Acceptance	Public prefers permanent remedy.	Public prefers permanent remedy.	Public prefers more permanent remedy.

Table 12A. Comparative Analysis of Alternatives - Former Neutralization Pond Operable Unit.

Criteria	(4) Multi-Layer Cover	(5) Multi-Layer Cap, Half Slurry Wall, and Extraction Wells	(5a) Hybrid-Multilayer Cap, Full Slurry Wall, and Ground Water Drain
1. Overall protection of human health and the environment.	Provides limited protection with cover. Materials remain in contact with ground water.	Some increased protection with separation of materials from ground water using the slurry wall.	Increased protection with separation of materials from ground water using the full slurry wall. Decreased maintenance with ground water drain.
2. Compliance with ARARs	Ability to achieve unlikely as long as materials are potentially in contact with ground water.	MCLs achieved in long-term. RCRA requirements may be achieved.	MCLs, RCRA requirements would be achieved. Maintenance requirements minimized.
3. Long-term effectiveness and permanence	In-place cover not as effective and permanent as full containment.	Effective as long as slurry wall is maintained; requires long-term treatment of ground water.	Permanent and effective as long as slurry wall is maintained; requires long-term treatment of ground water.
4. Reduction of toxicity, mobility, or volume through treatment	Cover would provide more reduction of mobility by minimizing infiltration than Alternative 3.	Reduction of mobility through containment. Reduction of toxicity, mobility, and volume through treatment of ground water.	Reduction of mobility through containment. Reduction of toxicity, mobility, and volume through treatment of ground water. Additional reduction of volume of ground water through full containment.
5. Short-term effectiveness	Limited risks to public and workers to implement.	Limited risks to public and workers to implement.	Limited risks to public and workers to implement.
6. Implementability	Short implementation time. Conventional construction procedures.	Short implementation time. Conventional construction procedures.	Short implementation time. Conventional construction procedures.
7. Cost	$1,860,000	$5,020,000	$5,290,000
8. Support agency acceptance	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. May have concerns regarding RCRA ARARs.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Requested explanation of compliance with RCRA and other ARARs.
9. Community acceptance	Public prefers more permanent remedy.	Public support mixed - concerns regarding long-term monitoring and financial assurance.	Public support mixed - concerns regarding long-term monitoring and financial assurance.

Table 12A. Comparative Analysis of Alternatives - Former Neutralization Pond Operable Unit.

Criteria	(6) Excavation of Materials, On-Site Subtitle C Disposal	(7) Excavation of Materials, On-Site Stabilization, Subtitle D Disposal	(8) Excavation of Materials, On-Site Stabilization, Off-Site Disposal
1. Overall protection of human health and the environment	Increased long-term environmental protection with full containment in landfill. Increased short-term risk with excavation.	Increased long-term protection with full containment and rendering materials non-hazardous. Increased short-term risk with excavation.	Long-term protection would be provided by complete removal of materials. Increased short-term risk with excavation.
2. Compliance with ARARs	Would not meet RCRA land disposal requirements for treatment.	Would be achieved.	Would be achieved.
3. Long-term effectiveness and permanence	Effective long-term containment.	Effective long-term containment.	Effective long-term containment.
4. Reduction of toxicity, mobility, or volume through treatment	Reduction of mobility through containment.	Reduction of toxicity, mobility through stabilization and containment. Increase in volume.	Reduction of toxicity, mobility through stabilization and containment. Increase in volume.
5. Short-term effectiveness	High potential for short-term release and migration of materials during the 2-year implementation.	Potential for short-term release and migration of materials during the 2-year implementation.	Potential for short-term release and migration of materials during the 2-year implementation.
6. Implement-ability	Extensive implementation plans and contingencies required.	Extensive implementation plans and contingencies required.	Extensive implementation plans and contingencies required.
7. Cost	$9,761,000	$19,508,000	$32,752,000
8. Support agency acceptance	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.
9. Community acceptance	Public acceptance mixed.	Public acceptance mixed.	Public acceptance mixed.

Table 12B. Comparative Analysis of Alternatives - Ground Water and Surface Water Operable Unit

Criteria	(1) No Action	(2) Periodic Monitoring	(3) Prevent Contact/ Slipline Farmers and Gardeners Ditch	(4) Terrace Drain/ Continuous Pipeline in IDD
1. Overall protection of human health and the environment	Not protective of human health. Contaminants would continue to move off-site.	Not protective. Contaminants would continue to move off-site.	Not protective. Contaminants would continue to move off-site. However, contamination of Farmers and Gardeners Ditch water would be prevented.	Risks reduced by collection and treatment of ground water at the terrace, capping of IDD sediments, institutional controls
2. Compliance with ARARs	Would not be achieved in ground water, IDD or FGD.	Would not be achieved in ground water, IDD or FGD.	Would not be achieved in ground water or IDD. Will be achieved in FGD.	Would be achieved in IDD. MCLs will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.
3. Long-term effectiveness and permanence	Risks from future ground water ingestion would continue. Contaminants would continue to move off-site.	Risks from future ground water ingestion would continue. Contaminants would continue to move off-site.	Risks from future ground water ingestion would continue. Risks from use of FGD water would be prevented.	Permanent remedy for the IDD water. Ditch sediment remedy less permanent. Risks reduced in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.
4. Reduction of toxicity, mobility, or volume through treatment	No reduction of toxicity, mobility, or volume.	No reduction of toxicity, mobility, or volume.	No reduction of toxicity, mobility, or volume. However, contamination in the FGD water would be prevented.	Toxicity and volume would be reduced by pump and treat of ground water at the terrace. Mobility of terrace ground water contaminants reduced. Mobility of IDD sediments reduced.
5. Short-term effectiveness	No short-term effectiveness, no short-term risks during implementation.	No short-term effectiveness, no short-term risks during implementation.	Short-term minimization of exposure through institutional actions.	Minimization of short-term exposure through institutional actions. Minimal short-term risks during implementation.
6. Implement-ability	No action easy to implement.	Monitoring easily implemented using existing wells.	Institutional actions to prevent contact are implementable.	Ground water removal/ treatment and IDD technologies are demonstrated and available.
7. Cost	0	$960,000	$1,030,000	$4,720,000
8. Support agency acceptance	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Unlikely to accept.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary. Acceptance likely.
9. Community Acceptance	Community preference for remedial action.	Community preference for remedial action.	Community preference for remedial action.	Community support mixed.

Table 12B. Comparative Analysis of Alternatives - Ground Water and Surface Water Operable Unit.

Criteria	(5) Terrace and Interceptor Trench Drains/Concrete Pipelines	(6) Terrace and Interceptor Trench Drains/Soil Lined Ditch	(6a Option) Terrace Drain/Sediment Removal and Soil Lined Ditch	(7 Option) Terrace and Interceptor Trench Drains/Slurry Wall (plus Alt. 4, 5, or 6)
1. Overall protection of human health and the environment	Risks reduced by collection and treatment of ground water at the terrace, capping of IDD sediments, institutional controls.	Risks reduced by collection and treatment of ground water at the terrace, capping of IDD sediments, institutional controls.	Risks reduced by collection and treatment of ground water at the terrace, removal of IDD sediments, institutional controls.	See alternatives 4, 5, or 6. No additional protectiveness.
2. Compliance with ARARs	MCLs will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years. Contaminated sediments remain in IDD.	MCLs will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years. Contaminated sediments remain in IDD.	Will be achieved in IDD. Ditch sediment disposal will meet solid waste ARARs. MCLs will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	See alternatives 4, 5, or 6.
3. Long-term effectiveness and permanence	Permanent remedy for the IDD water. IDD sediment remedy less permanent. Risks permanently reduced in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	Permanent remedy for the IDD water. IDD sediment remedy less permanent. Risks permanently reduced in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	Permanent remedy for the IDD water and sediments. Risks permanently reduced in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	See alternatives 4, 5, or 6. No additional effectiveness or permanence.
4. Reduction of toxicity, mobility, or volume through treatment	Toxicity and volume would be reduced by pump and treat of ground water at the terrace. Mobility of IDD sediments reduced.	Toxicity and volume would be reduced by pump and treat of ground water at the terrace. Mobility of IDD sediments reduced.	Toxicity and volume would be reduced by pump and treat of ground water at the terrace. Toxicity, mobility and volume of IDD sediments removed.	See alternatives 4, 5, or 6. Slurry wall would reduce volume of collected ground water.
5. Short-term effectiveness	Minimization of short-term exposure through institutional actions. Minimal short-term risks during implementation.	Minimization of short-term exposure through institutional actions. Minimal short-term risks during implementation.	Minimization of short-term exposure through institutional actions. Minimal short-term risks during implementation.	See alternatives 4, 5, or 6.
6. Implement-ability	Ground water removal/ treatment and IDD technologies are demonstrated and available.	Ground water removal/ treatment and IDD technologies are demonstrated and available.	Ground water removal and treatment technologies are demonstrated and available.	See alternatives 4, 5, and 6. Slurry wall technologies are demonstrated and available.
7. Cost	$5,160,000	$5,210,000	$5,220,000	$750,000 (plus cost of Alt. 4, 5 or 6)
8. Support agency acceptance	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.
9. Community acceptance	Community support mixed.	Community support mixed.	Community support mixed.	Community support mixed.

Table 12B. Comparative Analysis of Alternatives - Ground Water and Surface Water Operable Unit.

Criteria	(8 Option) Terrace and Interceptor Trench Drains/Localized Extraction (plus Alt. 4, 5, or 6)	(9) Option-Floodplain Extraction and Treatment	(9a) Hybrid Option - Floodplain Aquifer High Concentration Area Extraction and Treatment	(10) Option-Detention Pond and Dredging
1. Overall protection of human health and the environment	May provide accelerated cleanup of Plant site ground water. See alternative 4, 5, or 6.	Provides accelerated cleanup of floodplain ground water. See alternative 4, 5, or 6.	Provides accelerated cleanup of high arsenic contaminated area of floodplain. See alternative 4, 5, or 6.	Risks reduced by removing and disposing contaminated sediments. See alternative 4, 5, or 6.
2. Compliance with ARARs	See alternative 4, 5, or 6.	See alternative 5, 5, or 6. MCLs achieved in floodplain ground water in approximately 10 years.	See alternative 4, 5, or 6.	See alternative 4, 5, or 6. Standards not currently exceeded in detention pond water. Disturbance could cause exceedance.
3. Long-term effectiveness and permanence	Permanent remedy for the IDD water. Risks permanently reduced in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	Risks permanently reduced in floodplain ground water in approximately 10 years. See alternative 4, 5, or 6.	High risk area rapidly reduced in floodplain ground water. See alternative 4, 5, or 6.	Permanent and effective remedy by removing and disposing contaminated sediments. See alternative 4, 5, or 6.
4. Reduction of toxicity, mobility, or volume through treatment	Toxicity and volume would be reduced by pump and treat of ground water at the terrace. Mobility of IDD sediments reduced.	Toxicity and volume would be reduced by pump and treat of ground water at the terrace and floodplain. See alternative 4, 5, or 6.	Toxicity and volume would be reduced by pump and treat of ground water at the terrace and floodplain.	Mobility reduced by removing and disposing metals-laden sediments.
5. Short-term effectiveness	Minimization of short-term exposure through institutional actions. Highly contaminated ground water may be addressed more quickly. Minimal short-term risks during implementation.	Minimization of short-term exposure through institutional actions. Minimal short-term risks during implementation.	Minimization of short-term exposure through institutional actions. Minimal short-term risks during implementation.	Potential for adverse impacts during implementation can be minimized.
6. Implement-ability	Ground water removal and treatment technologies are demonstrated and available.	Difficulties possible due to land access for ground water piping.	Not difficult to implement due to close proximity to Plant site.	Feasible to implement.
7. Cost	$358,000 (plus cost of Alt. 4, 5 or 6)	$19,800,000	$360,000	$4,170,000
8. Support agency acceptance	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.	US EPA comments on Proposed Plan addressed in ROD and Responsiveness Summary.
9. Community acceptance	Community support mixed.	Community support mixed.	Community support mixed.	Community support mixed.

Table 12C. Comparative Analysis of Alternatives - Community Soils and Vegetable Gardens Operable Unit.

Criteria	(1) No Action	(2) Institutional Actions	(3) Soil Action Level 1 (Lead-1000 ppm, cadmium-73 ppm, arsenic-120 ppm)
1. Overall protection of human health and the environment	Not protective of human health and the environment.	Not protective of human health and the environment.	Would result in carcinogenic risks in 10^{-4} range for arsenic, and noncarcinogenic risks to within protective levels for cadmium.
2. Compliance with ARARs	No chemical specific ARARs exist for soils.	No chemical specific ARARs exist for soils.	Excavated materials meeting characteristic of TCLP toxicity will be handled in accordance with hazardous waste requirements. On-site disposal to meet landfill requirements.
3. Long-term effectiveness and permanence	Risks to human health and the environment would continue.	Risks to human health and the environment would continue.	Excavation and disposal permanent and effective. Capping effective but less permanent.
4. Reduction of toxicity, mobility, or volume through treatment	No reduction of toxicity, mobility or volume.	No reduction of toxicity, mobility or volume.	Excavation and disposal reduces toxicity and mobility. Capping reduces mobility.
5. Short-term effectiveness	No additional short-term effectiveness, no short-term risks during implementation.	Limited short-term effectiveness, no short-term risks during implementation.	Exposures may occur during excavation and transportation of the materials.
6. Implement-ability	No action easy to implement.	Institutional actions feasible to implement.	Technologies easily implemented. Implementation affected by space or access restrictions. Larger areas to remediate involve increasing levels of disruption.
7. Cost	$0	$50,000	$4,730,000
8. Support agency acceptance	US EPA acceptance unlikely.	US EPA acceptance unlikely.	US EPA position regarding this alternative unknown.
9. Community acceptance	Community preference for remedial action.	Community preference for remedial action.	General community preference for most stringent cleanup levels evaluated.

Table 12C. Comparative Analysis of Alternatives - Community Soils and Vegetable Gardens Operable Unit.

Criteria	(4) Soil Action Level II (Lead-500 ppm, Cadmium-73 ppm, Arsenic-120 ppm)	(5) Soil Action Level III (Lead-500 ppm, Cadmium-73 ppm, Arsenic-28 ppm)	(5a) Hybrid-Soil Action Level III (Lead-500 ppm, Cadmium-73 ppm, Arsenic Required-70 ppm, Arsenic Voluntary-upper limit of background)
1. Overall protection of human health and the environment	Will result in carcinogenic risks of 10^{-4} for arsenic, and noncarcinogenic risks within protective levels for cadmium and lead. More protective than Alternative 3.	Will result in carcinogenic risks of 10^{-5} for arsenic (background) and noncarcinogenic risks to within protective levels for cadmium and lead. More protective than Alternative 4.	Will result in carcinogenic risks of 10^{-5} for arsenic (background) and noncarcinogenic risks to within protective levels for cadmium and lead. More protective than Alternative 4.
2. Compliance with ARARs	Excavated materials meeting characteristic of TCLP toxicity will be handled in accordance with hazardous waste requirements. On-site disposal to meet landfill requirements.	Excavated materials meeting characteristic of TCLP toxicity will be handled in accordance with hazardous waste requirements. On-site disposal to meet landfill requirements.	Excavated materials meeting characteristic of TCLP toxicity will be handled in accordance with hazardous waste requirements. On-site disposal to meet landfill requirements.
3. Long-term effectiveness and permanence	Excavation and disposal permanent and effective. Capping effective but less permanent.	Excavation and disposal permanent and effective. Capping effective but less permanent.	Excavation and disposal permanent and effective. Capping effective but less permanent.
4. Reduction of toxicity, mobility, or volume through treatment.	Excavation and disposal reduces toxicity and mobility. Capping reduces mobility.	Excavation and disposal reduces toxicity and mobility. Capping reduces mobility.	Excavation and disposal reduces toxicity and mobility. Capping reduces mobility.
5. Short-term effectiveness	Exposures may occur during excavation and transportation of materials.	Exposures may occur during excavation and transportation of materials.	Exposures may occur during excavation and transportation of materials.
6. Implementability	Technologies easily implemented. Implementation affected by space or access restrictions. Larger areas to remediate involve increasing levels of disruption.	Technologies easily implemented. Implementation affected by space or access restrictions. Larger areas to remediate involve increasing levels of disruption.	Technologies easily implemented. Implementation affected by space or access restrictions. Larger areas to remediate involve increasing levels of disruption. More accessible due voluntary participation.
7. Cost	\$6,520,000	\$38,870,000	estimated range: \$8,000,000 to \$12,000,000
8. Support agency acceptance	US EPA position regarding this alternative unknown.	US EPA position regarding this alternative unknown.	US EPA Proposed Plan comments supportive of this alternative.
9. Community acceptance	General community preference for more stringent cleanup levels evaluated.	General community preference for most stringent cleanup levels evaluated.	General community preference for most stringent cleanup levels evaluated.

Table 12D. Comparative Analysis of Alternatives - Globe Plant Soils, Sediments, and Facilities Operable Unit.

Criteria	(1) No Action	(2) Periodic Monitoring	(3) Plant Site and Building Controls/In-Situ Stabilization of Sediments*
1. Overall protection of human health and the environment	Not protective of human health and the environment.	Not protective of human health and the environment.	Protection would be provided by covering/removal of Plant soils and by stabilization of sediments. Plant controls would reduce potential for ground water contamination.
2. Compliance with ARARs	Would not be achieved if sediments meet characteristic of TCLP toxicity.	Would not be achieved if sediments meet characteristic of TCLP toxicity.	Sediment remedy would meet hazardous waste laws. Plant building spill controls would meet substantive RCRA requirements.
3. Long-term effectiveness and permanence	Risks from Plant soils and sediments would continue.	Risks from Plant soils and sediments would continue.	Long-term effectiveness of in-situ stabilization is not well proven.
4. Reduction of toxicity, mobility, or volume through treatment	No reduction of toxicity, mobility or volume.	No reduction of toxicity, mobility or volume.	Spill controls reduce mobility of metals. Sediment remedies reduce mobility and toxicity of sediments.
5. Short-term effectiveness	No short-term effectiveness, no short-term risks during implementation.	Limited short-term effectiveness, no short-term risks during implementation.	Minimal short-term risks associated with implementation.
6. Implementability	No action easy to implement.	Periodic monitoring of ambient air and inspections of existing building controls feasible to implement.	Plant soil and building remedies easy to implement. In-situ sediment remedy not proven and difficult to implement.
7. Cost	$0	$410,000	$7,160,000
8. Support Agency Acceptance	US EPA unlikely to accept.	US EPA unlikely to accept.	US EPA position unknown.
9. Community Acceptance	Public prefers remedial action.	Public prefers remedial action.	Public prefers remedial action.

* Plant site and building controls include covering or excavation/disposal of soils, sealing of floors and sumps that are prone to leakage, and construction of a spill control pond. Alternatives 3 through 6 differ only in the manner in which sediments in the former sedimentation pond and 51st Avenue Retention Ponds are addressed.

Table 12E. Comparative Analysis of Alternatives - Globe Plant Soils, Sediments, and Facilities Operable Unit.

Criteria	(4) Plant Site and Building Controls/ Sediment Excavation and On-Site Disposal*	(5) Plant Site and Building Controls/Stabilization and On-Site Disposal*	(5a) Plant Site and Building Controls, Stabilization Pond, Removal and Off-Site Disposal of 51st Avenue Retention Pond Sediments*	(6) Plant Site and Building Controls/ Sediment Stabilization and Off-Site Disposal*
1. Overall protection of human health and the environment	Protection will be provided by covering/ removal of Plant soils and by stabilization of sediments. Plant controls will reduce potential for ground water contamination.	Protection will be provided by covering/ removal of Plant soils and by stabilization of sediments. Plant controls will reduce potential for ground water contamination.	Increased protection by covering/ removal of Plant soils, stabilization of sedimentation pond and removal of 51st Avenue Retention Pond sediments.	Protection will be provided by covering/ removal of Plant soils and by stabilization of sediments. Plant controls will reduce potential for ground water contamination.
2. Compliance with ARARs	Sediment remedy will meet hazardous waste laws. Plant building spill controls will meet substantive RCRA requirements.	Sediment remedy will meet hazardous waste laws. Plant building spill controls will meet substantive RCRA requirements.	Sediment remedy will meet hazardous waste laws. Plant building spill controls will meet substantive RCRA requirements.	Sediment remedy will meet hazardous waste laws. Plant building leak controls will meet substantive RCRA requirements.
3. Long-term effectiveness and permanence	Stabilization and disposal permanent and effective.	Stabilization and disposal permanent and effective.	Stabilization and disposal permanent and effective. Effectiveness of in-situ stabilization is not well proven.	Stabilization and disposal permanent and effective.
4. Reduction of toxicity, mobility, or volume through treatment	Spill controls reduce mobility of metals. Sediment remedies reduce mobility and toxicity of sediments.	Spill controls reduce mobility of metals. Sediment remedies reduce mobility and toxicity of sediments. Off-site disposal will remove sediments.	Spill controls reduce mobility of metals. Sediment remedies reduce mobility and toxicity of sediments.	Building controls reduce mobility of metals. Sediment remedies reduce mobility and toxicity of sediments.
5. Short-term effectiveness	Some short-term risks associated with excavation and handling of sediments.	Some short-term risks associated with excavation and handling of sediments.	Some short-term risks associated with excavation and handling of sediments.	Some short-term risks associated with excavation and handling of sediments.
6. Implement-ability	Plant soil and spill remedies easy to implement.	Plant soil and spill remedies easy to implement.	Plant soil and spill remedies easy to implement.	Plant soil and spill remedies easy to implement.
7. Cost	$6,490,000	$7,240,000	$7,410,000	$8,370,000
8. Support agency acceptance	US EPA position unknown.	US EPA position unknown.	US EPA position unknown.	US EPA position unknown.
9. Community acceptance	Community support mixed.	Community support mixed.	Community support mixed.	Community support mixed.

* Plant site and building controls include covering or excavation/disposal of soils, sealing of floors and sumps that are prone to leakage, and construction of a spill control pond. Alternatives 3 through 6 differ only in the manner in which sediments in the former sedimentation pond and 51st Avenue Retention Ponds are addressed.

Table 12E. Comparative Analysis of Alternatives - Globe Plant Point Source Air Emissions.

Criteria	1989 Case (no further controls)	FS Alternative 7 (Leaching Dept. controls, new baghouse in Retort Dept.)	FS Alternative 8 (Leaching Dept. controls, new baghouse in Retort Department, purification sponge stack controls, pulse air baghouse)	Air Emission Control Option 1 (Venturi scrubbers in Leaching and Solutions Departments. Secondary HEPA Filters on Sponge and Retort Depts.)
1. Overall protection of human health and the environment	Provides greater protection of human health than pre-1987 controls. Risk resulting from 1989 controls exceeds CERCLA risk range.	Provides greater protection of human health than 1989 controls.	Provides greater protection of human health than alternative 7.	Provides greater protection of human health than FS alternatives 7 or 8. Total risk reduction is dependent on HEPA performance.
2. Compliance with ARARs	Lead standard will not be exceeded. Numerical emission standards for cadmium and arsenic are not available.	Lead standard will not be exceeded. Numerical emission standards for cadmium and arsenic are not available.	Lead standard will not be exceeded. Numerical emission standards for cadmium and arsenic are not available.	Lead standard will not be exceeded. Numerical emission standards for cadmium and arsenic are not available.
3. Long-term effectiveness and permanence	1989 controls permanent but limited in effectiveness.	Pulse jet baghouse on the leaching department results in limited improvement in effectiveness.	Pulse jet baghouse on the leaching department results in limited improvement in effectiveness.	Leaching and solutions venturi scrubbers highly effective, secondary HEPA effectiveness needs to be demonstrated.
4. Reduction of toxicity, mobility, or volume through treatment	Provides reduction of toxicity and volume of air contaminants from pre-1987 controls.	Provides reduction of mobility and volume of air contaminants from 1989 levels.	Provides greater reduction of mobility and volume of air contaminants than FS Alternative 7.	Provides greatest reduction of mobility and volume of air contaminants.
5. Short-term effectiveness	No short-term effectiveness, no additional short-term risks during implementation.	Maximum effect of controls achieved once installed.	Maximum effect of controls achieved once installed.	Maximum effect of controls achieved once installed.
6. Implementability	All 1989 controls have been implemented.	All controls easily implemented. Retort baghouse already in place.	All controls easily implemented. Retort baghouse already in place.	Scrubbers can be implemented, secondary HEPA filters will require pilot tests.
7. Cost	$0 (no additional cost)	$2,170,000	$2,730,000	$5,790,000
8. Support agency acceptance	US EPA position unknown.	US EPA position unknown.	US EPA position unknown.	US EPA position unknown.
9. Community acceptance	Community prefers stringent controls or plant shut-down.	Community prefers stringent controls or plant shut-down.	Community prefers stringent controls or plant shut-down.	Community prefers stringent controls or plant shut-down.

Table 12E. Comparative Analysis of Alternatives - Globe Plant Facilities, Point Source Air Emissions.

Criteria	Air Emission Control Option 2 (ion wet scrubber in Leaching Dept. and Solution Dept., Secondary HEPA at Premelt and Retort Dept.)	Air Emission Control Option 3 (spray demister and baghouse in Leaching and Solution Dept., secondary HEPA in Premelt and Retort Dept.)	Air Emission Control Option 4 (modified charging hopper and baghouse in Leaching Dept.; wet scrubber in Solution Dept., secondary HEPA in Premelt and Retort Dept.)	Air Emission Hybrid Control Option 4 (modified charging hopper and baghouse in Leaching Dept., scrubber in Solution Dept., emission cap, secondary HEPA)
1. Overall protection of human health and the environment	Provides greater protection of human health than existing controls. Total risk reduction dependent on HEPA performance.	Provides greater protection of human health than existing controls. Total risk reduction dependent on HEPA performance.	Provides greater protection of human health than existing controls. Total risk reduction dependent on HEPA performance.	Provides greater protection of human health than existing controls or Alternatives 7 or 8. Total risk reduction dependent on pilot test results.
2. Compliance with ARARs	Lead standard will not be exceeded. Numerical standards for cadmium and arsenic are not available.	Lead standard will not be exceeded. Numerical standards for cadmium and arsenic are not available.	Lead standard will not be exceeded. Numerical standard for cadmium and arsenic are not available.	Lead standard will not be exceeded. Numerical standards for cadmium and arsenic are not available.
3. Long-term effectiveness and permanence	Ion scrubber would need pilot test to demonstrate effectiveness. HEPA effectiveness needs to be demonstrated.	Effectiveness uncertain for demister/baghouse. HEPA effectiveness needs to be demonstrated.	Scrubber/modified hopper effective. HEPA effectiveness needs to be demonstrated.	Scrubber/modified hopper effective once installed. HEPA effectiveness needs to be demonstrated.
4. Reduction of toxicity, mobility, or volume through treatment	Provides greater reduction of toxicity and volume of air contaminants than historical controls.	Provides greater reduction of toxicity and volume of air contaminants than existing emission controls.	Provides greater reduction of toxicity and volume of air contaminants than existing emission controls.	Provides greater reduction of toxicity and volume of air contaminants than existing controls or Alternative 7 or 8.
5. Short-term effectiveness	Maximum effect of controls achieved once installed.	Maximum effect of controls achieved once installed.	Maximum effect of controls achieved once installed.	Maximum effect of controls achieved once installed.
6. Implementability	Scrubbers can be implemented, secondary HEPA filters will require pilot tests.	Scrubbers can be implemented, secondary HEPA filters will require pilot tests.	Scrubbers can be implemented, secondary HEPA filters will require pilot tests.	Scrubbers can be implemented, secondary HEPA filters will require pilot tests.
7. Cost	$6,290,000	$5,490,000	$4,730,000	$1,450,000 to $4,880,000
8. Support agency acceptance	US EPA position unknown.	US EPA position unknown.	US EPA position unknown.	US EPA position unknown.
9. Community acceptance	Community prefers stringent controls or plant shut-down.	Community prefers stringent controls or plant shut-down.	Community prefers stringent controls or plant shut-down.	Community prefers stringent controls or plant shut-down.

SELECTED REMEDY

After reviewing each cleanup alternative for the areas of concern (the Former Neutralization Pond, ground water/surface water, community soils, and the Plant site), CDH has selected the remedies outlined below for the Asarco Globe Plant site. The remedies often involve selection of components from several alternatives in order to create a protective "hybrid" alternative for each operable unit. Some changes may be made to the selected remedy as a result of the remedial design and construction processes. Generally, such changes will reflect modifications resulting from the engineering design process. The selected remedies utilize permanent solutions and treatment technologies to the maximum extent practicable.

CDH estimates that the cost of installing these remedies (capital costs) will range from $18 to $25 million. Total costs for operation and maintenance and long-term monitoring are estimated to be $998,000 per year. The present value of these remedies over 30 years (assuming no contingencies are necessary) would be $27 to $34 million. In addition, state response costs of approximately $3 million and natural resource damages of $1 million will be paid by Asarco. A medical monitoring program will be paid for by Asarco and will be implemented by CDH.

Medical Monitoring

A medical monitoring program will be provided for site area residents interested in participating. The program will provide an assessment of individual health status and adverse health effects that may have occurred as a result of historical exposure to cadmium, arsenic, and lead related to the Globe Plant, or that may occur in the future due to site remediation. The biological monitoring will include a baseline assessment and assessment during remedial actions for current residents, and a voluntary program for former residents and workers. The program is based upon recommendations of the Medical Monitoring Advisory Group as outlined in their December, 1991 report to the state.

The surveillance program will be provided for all area residents living within a potential exposure "footprint" as defined by the geographic area where soil cadmium levels exceed the background levels established in the RI. The target population should include all residents who could potentially experience increased exposure to the metals of concern during remediation activities, as well as all residents who may have been historically exposed to metals related to the Globe Plant. The medical monitoring program will include:

1. A baseline assessment of all residents within the exposure "footprint", including indices of chronic, recent, and on-going exposures to arsenic, cadmium and lead. Indices of chronic exposure will include a measure of beta-2 microglobulin levels, urine creatinine level, hematocrit and hemoglobin levels, and urine cadmium. Indices of

current, on-going exposure will include biological monitoring of blood lead, hematocrit and hemoglobin levels, urine arsenic and urine and whole blood cadmium concentrations. This assessment will be completed before community soils or Plant site soils remediation begins.

2. Testing during community soils remediation will be provided to all residents within the exposure "footprint," to determine if there is any evidence of increased metal exposure associated with remedial activities. Assessment will consist of biological monitoring for current exposure, as described in item 1, and will be provided at the time that individual households are assumed to be at risk of the highest exposure, i.e., when remedial activities are occurring closest to their home. Extensive coordination and out-reach efforts will be necessary to identify and recruit residents to be tested while soil remediation activities are taking place. Particular effort will be exerted to recruit all children, pregnant women, nursing mothers, and women planning to become pregnant. Consultation and monthly follow-up will be provided for all women in any of these sensitive groups who are found to have a blood lead level greater than 10 ug/dl. Extensive coordination with laboratories and with construction management/oversight will be provided to expedite sampling results and require altered construction practices if necessary during remedial activities.

3. Voluntary testing will be available for all previous residents or workers who at one time lived or worked within the exposure "footprint". Testing for this group will be limited to assessment of chronic exposure, for anyone who has not lived or worked in the area in the past three months. There will be active recruitment of former Stapleton Homes residents. Other voluntary populations eligible for the full spectrum of testing will include residents who believe that their exposure levels have changed and wish to be retested, current area workers, those who could not participate during active remediation, those wishing to be retested after their initial assessment, and anyone living near the exposure "footprint" boundary who has specific health concerns related to exposures from the Globe Plant and who wishes to be tested.

4. Support services will be provided to encourage participation in the medical monitoring program, including door-to-door recruitment to schedule home visits for all residents currently living within the geographical boundary described by the cadmium exposure "footprint". In addition, trained staff will collect and analyze samples, conduct home visits, develop a database to organize collected data, and analyze and report results. A community outreach worker will be available to explain each individual's medical monitoring results, provide follow-up where indicated, as well as provide general education to the community on issues relating to metal exposure and health outcomes. A bilingual interpreter will be available on an as-needed basis. A physician with expertise in metal toxicity will be available on a part-time basis to discuss health issues with program participants and provide referrals for further medical assessment as indicated.

5. CDH will evaluate long-term carcinogenic effects by updating the cancer survey report released in 1989. The 1989 report analyzed all of the validated cancer data available from the Colorado Central Cancer Registry at that time (1980-1986). This update will include cancer incidence data for 1980 through 1990 for all cancer sites known to be associated with the metals identified as the chemicals of concern. Because there is no known association between exposure to cadmium, arsenic or lead and cancer of the nasal cavity, this cancer site will not be assessed in this update. Cancer of the larynx will be retained because of a known association with chemicals in acid mists. Internal cancer sites that have been associated with inorganic arsenic ingestion, i.e., cancer of the lung, liver, bladder, and kidney, will be added to this cancer survey update. Due to the high percentage of hispanics living in the Globe area, CCCR will calculate race/ethnicity adjusted cancer incidence rates in this update.

The medical monitoring program described above is most effective as a service to the individual Globeville resident. However, individual results from the target population will be used where possible to assess community health status as a whole.

Follow-up, consultation and education to the community are vital to the success of the medical monitoring program. A community outreach worker will be made available to consult with community members on health issues, explain their medical monitoring test results, provide general education on metals-related health effects, and encourage participation in the program. As a service to the community, the outreach worker should provide information on services available at the local health clinic. The outreach worker should also provide general information to the community on ways to reduce exposures by distributing brochures, presenting informational videos and meetings with small groups at schools, churches, community organizations, or public meetings, as requested by the community.

Anyone participating in the medical monitoring program who is found to have an analytical result that exceeds a normal reference range for an unexposed population, as established in the current scientific literature, will first receive follow-up testing to confirm the validity of the laboratory test result. If found to be accurate, this person will then receive medical consultation and possibly environmental sampling of the home environment, if other intervention strategies prove ineffective. For individuals that are not referred by the physician for further medical assessment, but who still have health concerns or general questions, small group meetings will be organized to answer these questions and provide general health information.

Procedures described in the October, 1991 CDC Guidelines for Preventing Lead Poisoning in Young Children will be used for a follow-up program for all children, ages 6 months to 72 months, with a blood lead level greater than 10 ug/dl.

Former Neutralization Pond

In-place closure with slurry wall, multi-layer cap (modified Alternative 5), maintain inward ground water flow with gravity drain; treatment of collected ground water; periodic monitoring (Alternative 2), and institutional controls.

Remedy Description

The Former Neutralization Pond materials will be closed in-place by: covering the pile with a multi-layer RCRA Subtitle C equivalent cap; installing a slurry wall that completely encircles the materials and extends down to the lower clay layer to a depth sufficient to prevent underflow; installing a drainage system that drains ground water from within the slurry wall to the terrace drain system; and collecting contaminated liquids from the drainage system for treatment at Asarco's wastewater treatment plant (Figure 5). Collected liquids will be treated as necessary at the Plant wastewater treatment plant and discharged to 1) the sanitary sewer under Asarco's existing wastewater treatment permit (treatment and volumes must meet existing permit requirements); 2) surface water per CoPDES permit requirements; or 3) through underground injection (treatment would meet MCLs). The cap will consist of the following layers: a foundation layer, a 2 to 3 foot layer of low permeability clay, a low-permeability membrane (e.g. HDPE) layer, a geotextile protection layer, a drainage layer, a filter layer, and a topsoil layer with vegetation. The cap will be designed and constructed in accordance with available EPA RCRA Subtitle C landfill cap guidance.

Monitoring Requirements

Concentrations of contaminants in the ground water within the containment system and outside the slurry wall will be monitored. These data must show a general and overall decline in contaminant concentrations within the slurry wall over time. Points of compliance will be established outside of the slurry wall containment system to monitor the migration of the currently contaminated ground water as it migrates to the terrace drain collection system. Ground water gradients throughout the containment system will be monitored. Inward horizontal and vertical gradients must be present along the perimeter of the slurry wall throughout the depth of the slurry wall, and beneath the contaminant waste mass. Ground water levels within the slurry wall containment system will be brought below the bottom elevation of the waste materials. Thereafter, ground water levels must consistently remain below this level, throughout the interior of the slurry wall. It must be demonstrated that the waste materials do not release significant contaminants to the ground water on a continuing basis. Volumes of collected ground water will be monitored. The collected volumes will be correlated to estimates of volumes entering the containment system if the design permeabilities of the slurry wall and cap were maintained. Performance monitoring with appropriate performance standards will be performed to demonstrate that the complex cap minimizes infiltration through the waste materials, or along the edges of the waste materials.

FIGURE 5

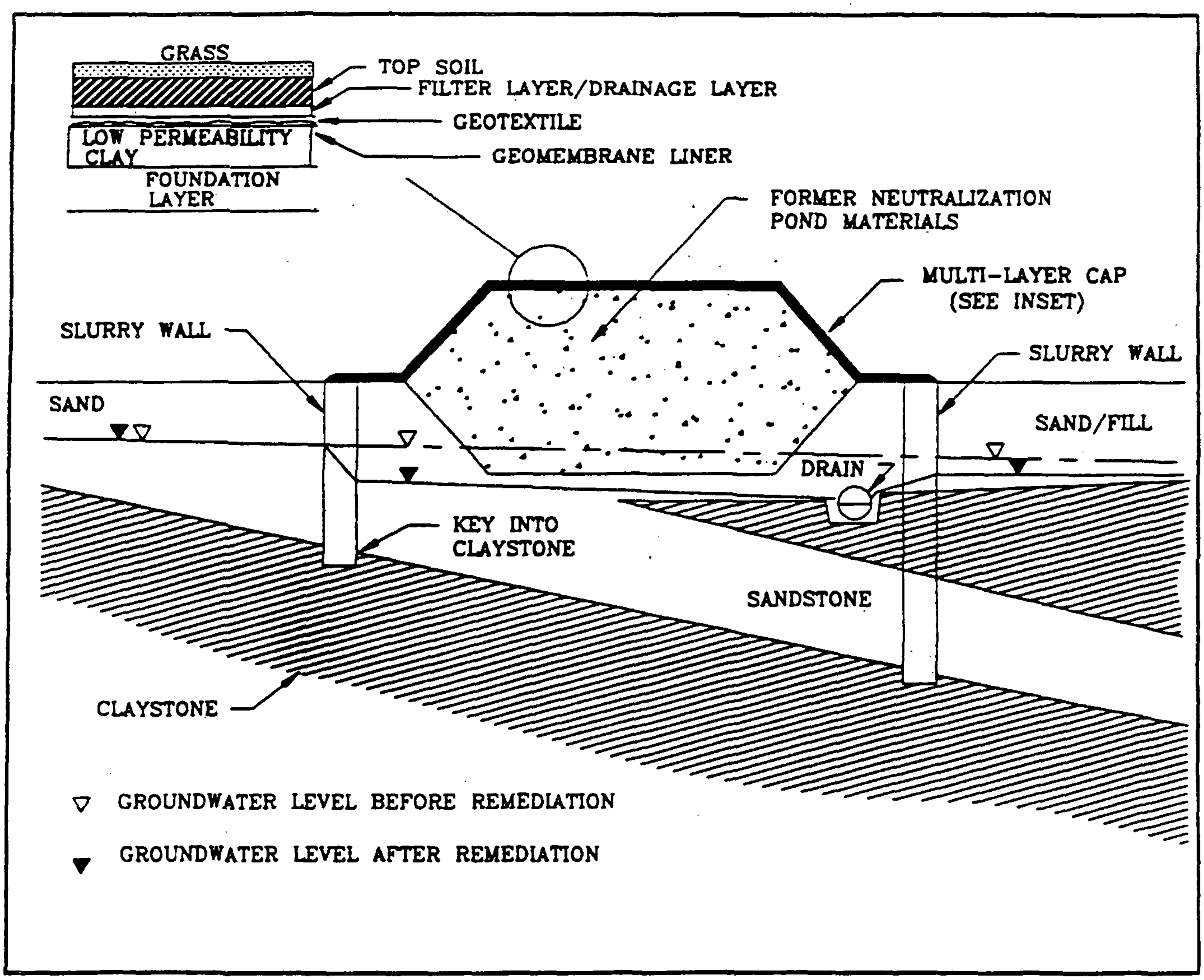


FIGURE 5 FORMER NEUTRALIZATION POND CROSS SECTION

Contingency

Numerical performance limits, such as flow rates and water level measurements, will be established to monitor the effectiveness of the proposed remedy. If these limits are exceeded there would be an investigation and possible repairs; if repairs are not effective, the contingent remedy will be required.

The contingency remedy will require excavation of Former Neutralization Pond materials, treatment of the materials to render the materials non-hazardous, and placement of the treated materials in an on-site solid waste landfill. Monitoring requirements are the same for the contingency remedy, and the ARARs described in the Statutory Determinations section of this ROD include those that would pertain to the contingency remedy.

Risk Reduction

Capping of the materials will prevent direct human contact with the materials and wind-blowing of particles. The cap also provides long-term protection against surface water contacting the materials. In addition, the composite cap will prevent or minimize infiltration of precipitation into the materials thereby minimizing leachate production and subsequent migration into ground water. Waste materials will be isolated from the surrounding ground water by the combination of the slurry wall and ground water drain system, thus preventing migration of contaminants into the surrounding ground water. The ground water drain system minimizes maintenance requirements for extraction of ground water.

Institutional Controls

Deed restrictions will denote that the Former Neutralization Pond area is a waste disposal site and will include the following restrictions:

* restriction against excavating into the cover and/or Former Neutralization Pond materials;

* restriction to prohibit the construction of structures on the disposal site;

* restriction against using the ground water located within the slurry wall;

* restriction against using the ground water located outside the slurry wall until it achieves MCLs; and

* restriction to prevent agricultural use of the Former Neutralization Pond area.

Cost

Capital costs associated with the proposed Former Neutralization Pond remedy are estimated to be $3,437,000. Costs for operation, maintenance, and long-term monitoring are estimated to be $197,000 per year. The present value cost for this remedy over 30 years is estimated to be $5,293,000.

Ground Water/Surface Water

Terrace drain system (portion of Alternative 4), excavation and disposal of IDD and Retention Ponds sediments (Alternative 6), periodic monitoring (Alternative 2), institutional controls (Alternative 3), contingency for covering Detention Pond sediments (Alternative 10).

Remedy Description

The proposed ground water remedy will include: a terrace drain system installed along the length of the Globe Plant terrace that intercepts and collects the contaminated ground water from the terrace (Figure 6); local extraction of arsenic-contaminated floodplain ground water near the northeast corner of the Plant site, as necessary; and treatment of collected contaminated ground water at Asarco's wastewater treatment plant. The remaining floodplain contaminated ground water will be allowed to naturally flush through time.

Shallow ground water will be collected in a subsurface drain approximately 2100 feet in length located along the length of the Plant terrace (Figure 7). The drain will be excavated into the top of the underlying claystone bedrock. The drain will cut off and collect shallow contaminated ground water flow from the sandstone and alluvial deposits on the terrace, preventing further contamination of the floodplain shallow aquifer. An area of floodplain ground water in the vicinity of monitoring well GW-64 currently has high levels of arsenic contamination. If necessary, local extraction wells will be installed to withdraw highly contaminated ground water. The extracted ground water will be pumped to the existing Plant wastewater treatment system.

Collected ground water will be pumped to the existing Plant wastewater treatment plant and treated as necessary. After treatment, the water will be discharged to 1) the sanitary sewer under Asarco's existing wastewater treatment permit (treatment and volumes must meet existing permit requirements); 2) surface water per CoPDES permit requirements; or 3) through underground injection (treatment would meet MCLs). The existing Plant treatment plant has sufficient capacity to treat collected ground water.

FIGURE 6

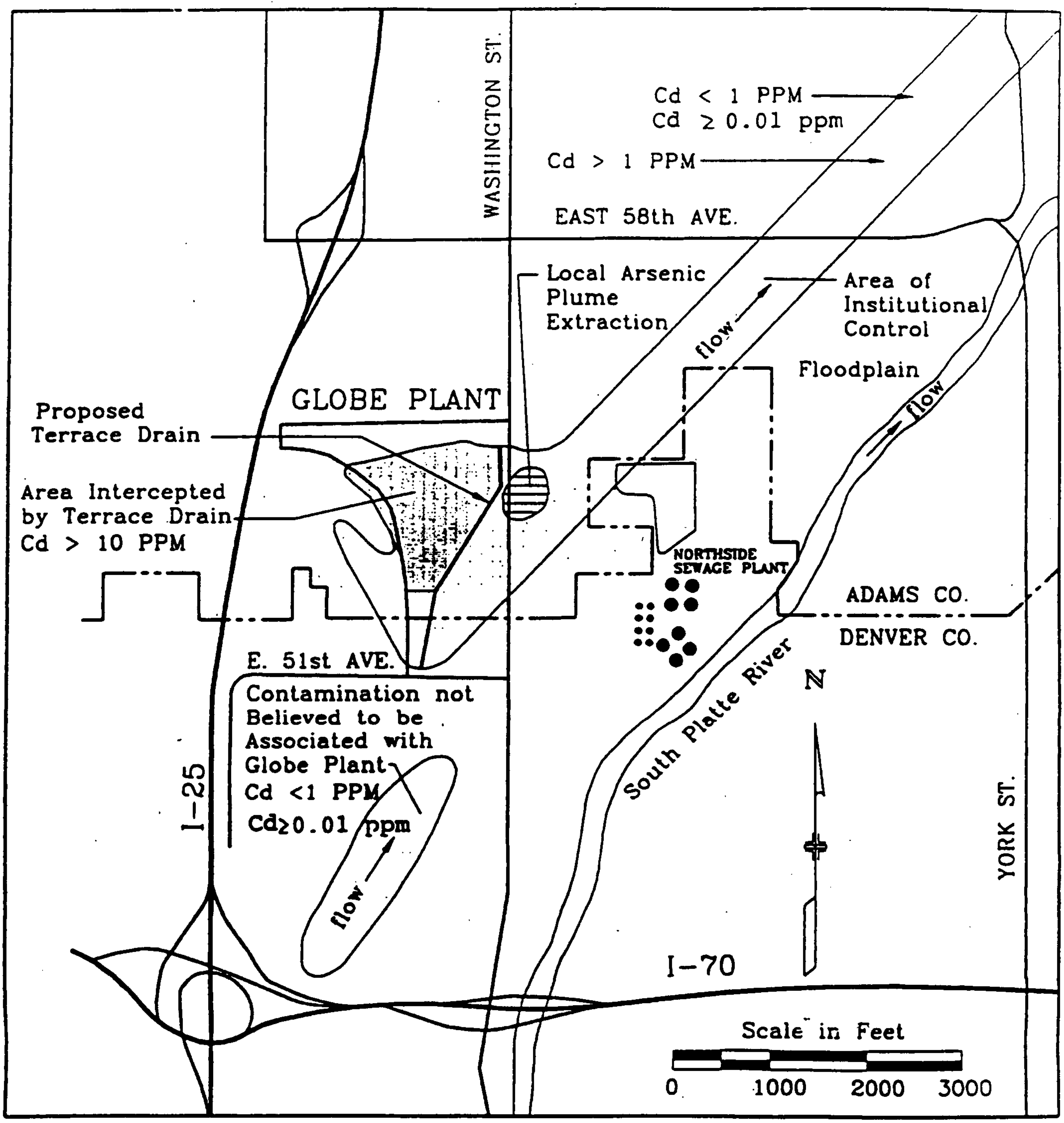


Figure 6 Groundwater Plume Map

FIGURE 7

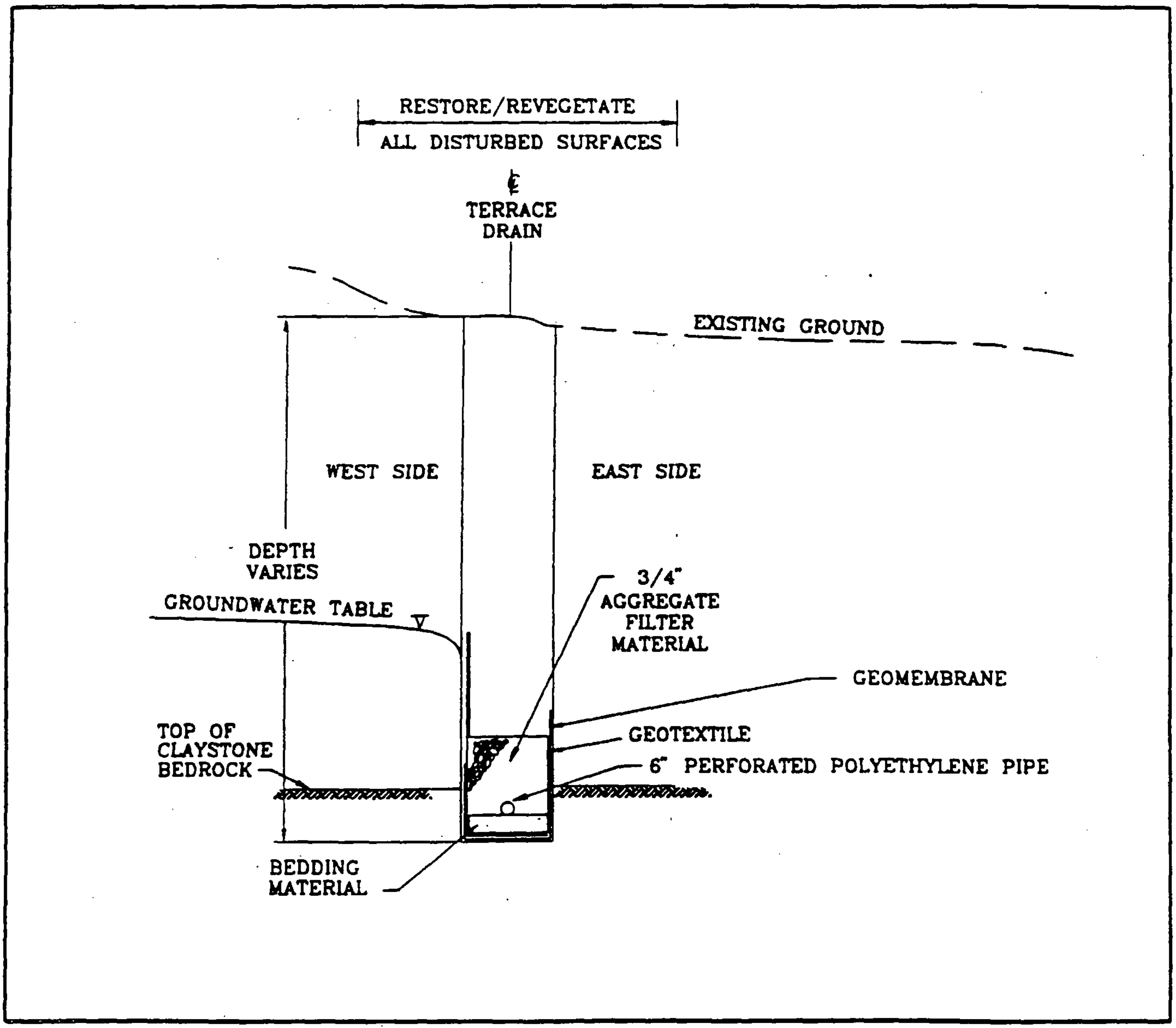


FIGURE 7 TERRACE DRAIN CROSS SECTION

For the surface water cleanup, contaminated sediments will be removed from the IDD and the Retention Ponds. The sediments will be dewatered, treated as necessary, and placed in a secure landfill. The sediments will be tested, and if characterized as hazardous, they will be managed in accordance with RCRA Subtitle C land disposal requirements. The IDD and Retention Ponds will be restored to their previous condition and designation through placement of clean borrow soils and establishment of appropriate vegetation.

Based on the results of a pilot test, placement of the completed terrace drain should maintain the FGD water quality to meet agricultural water quality standards. If Detention Pond sediments exceeding community soils action levels become exposed for a prolonged period of time, they will be covered with 12 inches of clean soil or excavated. Detention pond dredging involves removal of sediments from the detention pond by hydraulic dredging methods, followed by dewatering and disposal of the sediments. Once excess water is removed from the sediments, they will still be very wet and may need to be stabilized prior to disposal. Accordingly, the alternative includes a lined dewatering pad, stabilization and on-site disposal. The dewatering pad would consist of two cells, allowing processing of dewatered sediments from one cell, while the other cell is being filled with dredged sediments.

Monitoring Requirements

A long-term monitoring system will be implemented to determine whether the terrace drain collects the contaminated ground water from the terrace. Should contaminated ground water be moving under or through the drain system, an investigation, and if necessary, repair will be required. Contaminant levels will also be monitored in floodplain ground water. Points of compliance will be established down-gradient of the terrace drain system and along the contaminated plume. These points of compliance will be used to determine if 1) the terrace drain is efficiently collecting contaminated terrace ground water; 2) contaminant concentrations are declining in the floodplain as expected due to natural attenuation and ground water flushing; and 3) the floodplain contaminant concentrations do not exceed the interim narrative standards for the respective contaminants. Terrace ground water will achieve MCLs in approximately 30 years and floodplain ground water will achieve MCLs in approximately 100 years. Water quality in the FGD will be monitored to ensure that the FGD water remains below agricultural water quality standards. Surface water quality and sediment quality in the IDD will be monitored to ensure that contaminated ground water does not recontaminate the IDD water or sediments.

Risk Reduction

Risk reduction will be achieved through prevention of ground water use through institutional controls and will be provided by long-term restoration of terrace and floodplain ground water. Carcinogenic and non-carcinogenic risk associated with contaminated IDD sediments will be removed through removal of the sediments. Risk reduction for the detention pond is achieved through prevention of contact with the detention pond sediments if the sediments become exposed.

Institutional Controls

Institutional controls will be necessary to prevent use -f the Plant site and floodplain ground water as long as it remains contaminated. The installation of water supply wells within the contaminated portions of the floodplain aquifer is prohibited by existing regulations. Institutional controls similar to those specified for the Former Neutralization Pond Operable Unit will also be implemented to ensure the long-term integrity of any on-site sediment disposal facility. Requirements that contaminated ground water withdrawal and treatment be continued as long as ground water remains contaminated will also be necessary.

Cost

Capital costs associated with the proposed ground water and surface water remedies are estimated to be $2,053,000. Costs for operation, maintenance, and long-term monitoring are estimated to be $336,000 per year. The present value of these costs over 30 years is estimated to be $5,224,000.

Community Soils

Action levels of cadmium = 73 mg/kg, lead = 500 mg/kg, or arsenic = 70 mg/kg; zinc = 500 mg/kg in gardens (Components of Alternatives 4 and 5). Buffer cleanup provided upon request in residential areas where arsenic exceeds upper limit of background. Implementation of public information and education (Alternative 2). Remedial actions include excavation, capping, exposure controls, and/or deep tilling.

Remedy Description

The community soils remedy will require remedial action in any area where soil contaminant levels exceed any of the following action levels: cadmium = 73 mg/kg, lead = 500 mg/kg, or arsenic = 70 mg/kg. In addition to levels for cadmium, lead, and arsenic, an action level for zinc of 500 mg/kg will apply to existing vegetable gardens. A buffer cleanup area adjacent to areas exceeding the 70 mg/kg arsenic action level will be offered for residential areas where arsenic levels are between the upper limit of background (as defined in the RI as 28 mg/kg) and 70 mg/kg (Figure 8). Remediation will be provided upon request of the property owner in those residential areas. It is likely that soil cleanup in the areas described by the arsenic action levels will result in cleanup of areas where lead exceeds the upper limit of background concentrations.

FIGURE 8

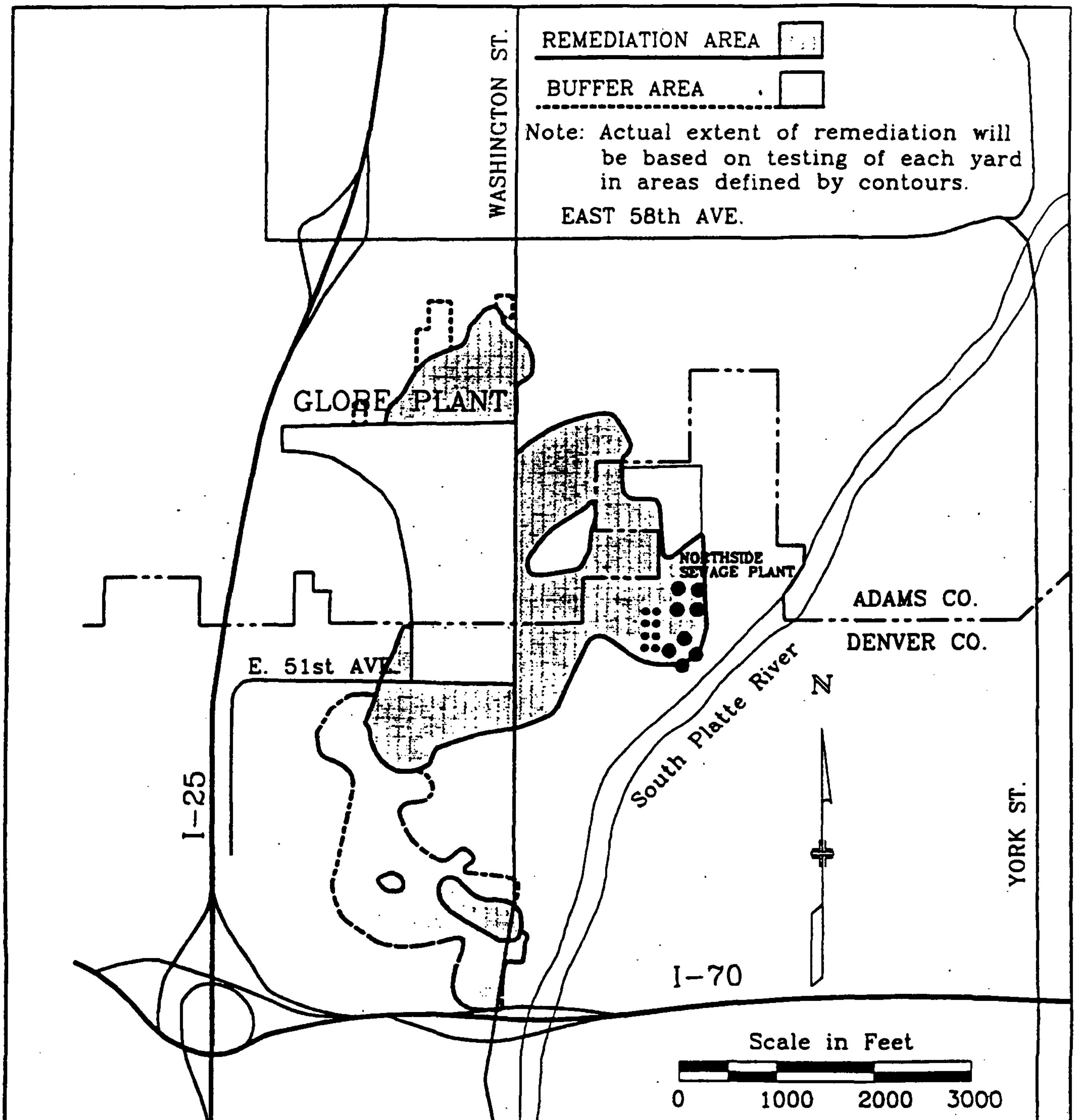


Figure 8 Community Soils Cleanup

An extensive sampling effort will verify contaminant levels in areas where previous sampling indicated action levels may be exceeded. Priority for sampling will be given to schools, day care centers, and parks. Sampling results will be provided to property owners. Property owners within the buffer area will be given the opportunity to have their properties remedied, if the arsenic concentrations exceed the upper limit of background. The voluntary program will be made available for a specified time period and will not be re-introduced once this period is over. Based upon the results of the voluntary program, plans will be prepared and remedial action would take place.

Remedial actions will include excavating, capping, exposure controls, and/or deep tilling. In general, a cover of 12 inches of soil is considered to be an adequate barrier. Soil caps, including sod or seeding with native grasses as appropriate, will be a minimum of 12 inches thick over soils exceeding action levels. Alternately, soils with metals concentrations exceeding action levels will be excavated. Excavated soils will be replaced with clean borrow soils. The ground surface will be restored to its original condition after placement of the borrow soils; for example, by placing sod in previously vegetated areas. Excavation will take place as necessary to achieve proper grades.

In vegetable gardens with soils having metals concentrations exceeding the garden action levels, the soils will be remediated by either excavation and replacement of 18 inches of soil, or covering of the garden by 18 inches of clean soil, depending on the grade requirements and the preference of the property owner. In addition, during community soils remedial activities, any resident wishing to plant vegetable gardens in new areas of his/her yard may request soil sample analysis at a depth of 12 inches. Soil sampling and analysis, or additional soil will be provided. If the sample exceeds action levels, clean soil will be provided such that a total depth of 18 inches of clean soil is in place for the new garden. After community soils remediation has been completed, CDH will evaluate whether to continue this program.

For design purposes, a model residential cleanup scenario will be developed for each parcel designated for cleanup. The general components of the model residential cleanup are outlined below, including a preliminary identification of options and alternatives.

1. Contaminated Soil: Removal of minimum 12 inches; replacement with equivalent depth demonstrated uncontaminated native soil. Options include removal of less depth as long as 12-inch barrier is maintained and local grade is maintained.

2. Existing Sod (yards, parks, and other landscape areas): Removal and replacement with provision for irrigation for one growing season. Options include removal with no replacement.

3. Vegetation in Fields or Lots: Remove and replace with dry farm native mix.

4. Shrubs and/or Bushes (defined as low, densely branched plants that will impede soil removal): Remove and replace with same species and quantity.

5. Perennial Plants: Removal with new plants provided to homeowner for their replacement.

6. Annual Plants: Removal with no replacement.

7. Existing Sprinkler Systems: Remove and replace with equivalent system if the system impedes soil removal.

8. Concrete Surfacing (sidewalks, driveways, parking lots, pads): Remain in place and excavate around. If surfacing is damaged to the point of exposing contaminated soils, then remove and replace surfacing with equivalent or better materials.

9. Asphalt Surfacing: Remain in place and excavate around. If surfacing is damaged to the point of exposing contaminated soils, then remove and replace surfacing with equivalent or better materials.

10. Brick, Stone, or Tile Surfacing: Remain in place and excavate around. If surfacing is damaged to the point of exposing contaminated soils, then remove and replace surfacing with equivalent or better materials.

11. Gravel and/or Sand Surfacing (sidewalks, sandboxes, driveways, parking lots, pads, etc.): Remove and replace with equivalent or better materials.

12. Fences (post-type and masonry-type): Remain in place and excavate around. Remove and replace with equivalent or better materials if unable to excavate around.

13. Existing Landscape Covers and Borders: Remove and replace with equivalent or better materials.

14. Mobile Homes: Removal of soil beneath mobile home and re-establish adequate skirting. Option includes temporary move of mobile home.

15. Domestic Animals and Poultry: Temporary relocation during remediation, if necessary.

16. Movable Buildings and Sheds: Temporary relocation during remediation.

17. Vegetable Gardens: Removal of minimum 18 inches of contaminated soils and replacement with demonstrated non-contaminated garden quality fertile soil.

18. Home Interior Cleaning: Removal of dirt and dust resulting from remedial activities, as necessary.

Deep tilling generally consists of turning soils over and mixing them with deeper, less contaminated soil. Deep tilling is effective where the depth of contaminated soils is less than the maximum depth of tilling.

Asarco will work with individual property owners to gain approval of the model design as is or with various alternatives or options that are mutually agreeable. After approval, construction will begin. The remedial activities will be conducted in small areas so as to minimize fugitive dust and traffic. Order of remediation will progress from required residential areas, to voluntary residential areas, to commercial properties. Schools and parks will be given priority, although it is believed that no schools are currently located in the areas of cleanup.

Excavated soils will be characterized to determine if they must be managed as hazardous wastes. If considered a characteristic hazardous waste, the soil will be taken to an off-site licensed hazardous waste disposal facility, as appropriate and consistent with RCRA Subtitle C requirements. If the soils are not characterized as hazardous, they may be considered for placement on the Asarco Plant site. Excavated community soils that are contaminated below levels established to protect the health of Plant site workers or trespassers will be placed on the Asarco Plant site and used for landscaping, covering the slag pile, or covering areas of soil with higher levels of contamination. Soils placed upon the Plant site must meet the technical requirements of a Solid Waste Certificate of Designation. This includes provisions to demonstrate that the materials are not a source of ground or surface water contamination. Performance standards regarding windblown dust, vegetation success, and surface water erosion control will be established.

Educational Program

A bilingual public information, education, and awareness program will be implemented in the area surrounding the Plant. The state and Asarco will conduct joint risk and remediation education efforts for those residences eligible for remediation, that will describe estimated levels of risk and the activities that will occur during remediation. The purpose of the program will be to inform persons in the area of levels of risk, how the risk is incurred, what they can expect from cleanup activities, and practices and procedures that are available to reduce the risk of potential exposure to metals in the soils. These practices will be useful for individuals of all ages but would be especially directed towards parents of young children. These practices include, but are not limited to, thorough washing of home grown vegetables, vegetating or paving barren areas, washing hands prior to eating, and encouraging children to play in areas that are not barren soil.

Institutional Controls

Institutional controls will be considered for those properties in the required remediation area where access cannot be obtained to carry out remedial activities. Controls will also be implemented to maintain use restrictions on Plant site property where excavated community soils have been placed.

Risk Reduction

The required arsenic action level, 70 mg/kg, is equivalent to a 8.0×10^{-5} excess cancer risk based on RAGS methodology; the FS estimated excess cancer risk level was 5.8×10^{-5} based on SPHEM methodology. This represents a reduction from the maximum risk due to ingestion of community soil of 9.2×10^{-3} calculated in the PHE. Remediation within the voluntary buffer zone would achieve an excess cancer risk due to arsenic exposure of 3.0×10^{-5}, estimated using on RAGS methodology. The cadmium and zinc action levels are based upon health protective levels (hazard index of < 1 based on RAGS methodology), as compared to a maximum hazard index of 273 calculated in the PHE. In vegetable gardens, the zinc action level of 500 mg/kg is based upon plant phytotoxicity. Risk reductions are achieved through removal, covering, or deep tilling of contaminated soils.

The site action level for lead of 500 mg/kg is based upon EPA's OSWER Directive #9355.4-02, dated September 7, 1989. In an August 29, 1991 memorandum, EPA discusses use of the uptake-biokinetic (UBK) model as a risk management decision-making aid when setting soil lead cleanup levels in residential areas. If, prior to completion of a remedial action for community soils, EPA guidance is changed to formally advise use of UBK to establish action levels for lead in soils for CERCLA remedies, this guidance will be evaluated to determine its appropriateness for this site. If determined appropriate, Asarco will either expand the area of remediation into adjacent areas not previously remediated that have a lead level between the upper limit of background (413 mg/kg) and 500 mg/kg, or obtain the samples necessary to correctly model impacts to individuals under the UBK model. Since this model calculates blood lead impacts, additional remediation or sampling would be limited to residential areas with soil lead levels between 413 mg/kg and 500 mg/kg. The state may at any time use UBK to evaluate remedy protectiveness under the reopener provisions of the Consent Decree.

Cost

Capital costs associated with the proposed community soils remedy depend on site-specific sampling results and participation rates. Estimated costs range from $8 to $12 million. Costs for operation, maintenance, and long-term monitoring are included in the Plant site cost estimates.

Plant Site

Further air pollution point source controls and fugitive emission and dust controls (Option 4 with pilot test of HEPA filters); emissions cap of 162 kilograms cadmium per year. Excavation, covering, deep tilling, or exposure controls for Plant site soils above worker or trespasser action levels (Alternative 3). Excavation and stabilization of sediments (Alternative 5). Sealing of floors and sumps as necessary; secondary containment in Plant sumps; spill control retention pond (Alternative 3).

Remedy Description

Remedial actions for point source air emissions include a charging hopper with cover and baghouse for the leaching department, a venturi scrubber in the stack at the solution/purification department and, depending on the results of pilot testing, secondary high efficiency particulate air (HEPA) filters on premelt and/or retort department baghouses. These controls are in addition to existing controls (Figure 9).

Controls and process modifications installed after 1987 include installation of a baghouse in the premelt casting department; modification of ventilation systems and addition of dust collection systems in premelt, cadmium oxide retort, and litharge departments; and installation of a caustic scrubber in the ventilation system at the wastewater treatment plant. Following implementation of the remedy, inlet and outlet stack testing of all point sources will be conducted to verify actual emission rates and control efficiencies.

Cadmium emissions from point sources will be limited to 162 kilograms per year (approximately 350 pounds per year), a reduction of approximately 88% from the average annual emissions in the 1987-1992 time period (Figure 10). The limitation will be accomplished through further emission controls or production limitations, as necessary. Asarco will also be implementing a state-approved fugitive emissions control plan for the site, as well as installing broken bag detectors on its baghouses.

Use of HEPA filters is a potentially promising secondary control for point source emissions but further analysis is necessary regarding the feasibility, implementability and cost of these filters in an industrial process setting. Therefore, the remedy includes the pilot testing of these controls, with subsequent evaluation after a one-year test period. The evaluation of the pilot test results, and the feasibility of installing HEPA filters, will be performed using the nine evaluation criteria described by CERCLA. The Colorado Air Quality Control Commission has independent authority to determine appropriate controls for hazardous air pollutants such as cadmium. CDH may also seek the Commission's review to determine if additional controls are necessary.

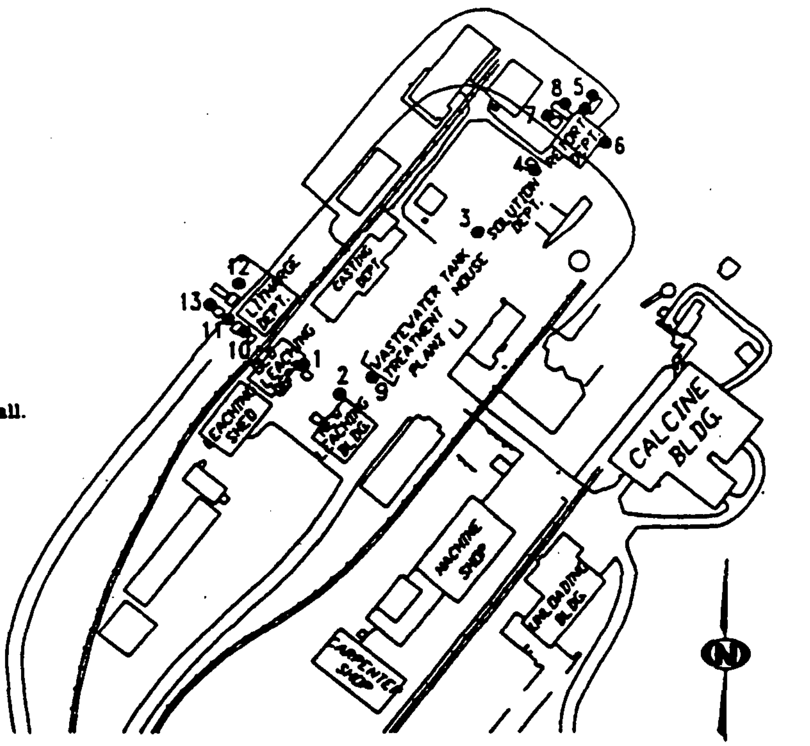
FIGURE 9

1 Leaching Department Stack
Emissions from hot water & acid leaching operation.
- Pre-1987 - none
- Current - none
- Proposed controls - Provide charging hopper with cover & baghouse

2 Premelt Stack
Emissions from premelt operation.
- Pre-1987 - None
- Current - Baghouse & modified ventilation hood.
- Proposed - Secondary HEPA install.

3 Sponging Department Stack
Emissions from sponge production.
- Pre-1987 - None
- Current - None
- Proposed - None

4 Solution Purification Stack
Emissions from purification & solution operation.
- Pre-1987 - None
- Current - None
- Proposed - Venturi scrubber in stack



PORTION OF GLOBE PLANT

0 100 200
SCALE (FEET)

5 Cadmium Oxide Production
- Pre-1987 - Alternate baghouses #1 & #2
- Current - Modified manifold & offgas production
- Proposed - Secondary HEPA install.

6 Cadmium Powder Packing
- Pre - 1987 - Dust Collector #3
- Current - Modified off gas / product ventilation, condenser/tote transfer & enclosed operation.
- Proposed - Secondary HEPA install.

7 Cadmium Oxide Packing
- Pre-1987 - Duster collector #1
- Current - Alternate dust collectors #1 and #2.
- Proposed - Secondary HEPA install.

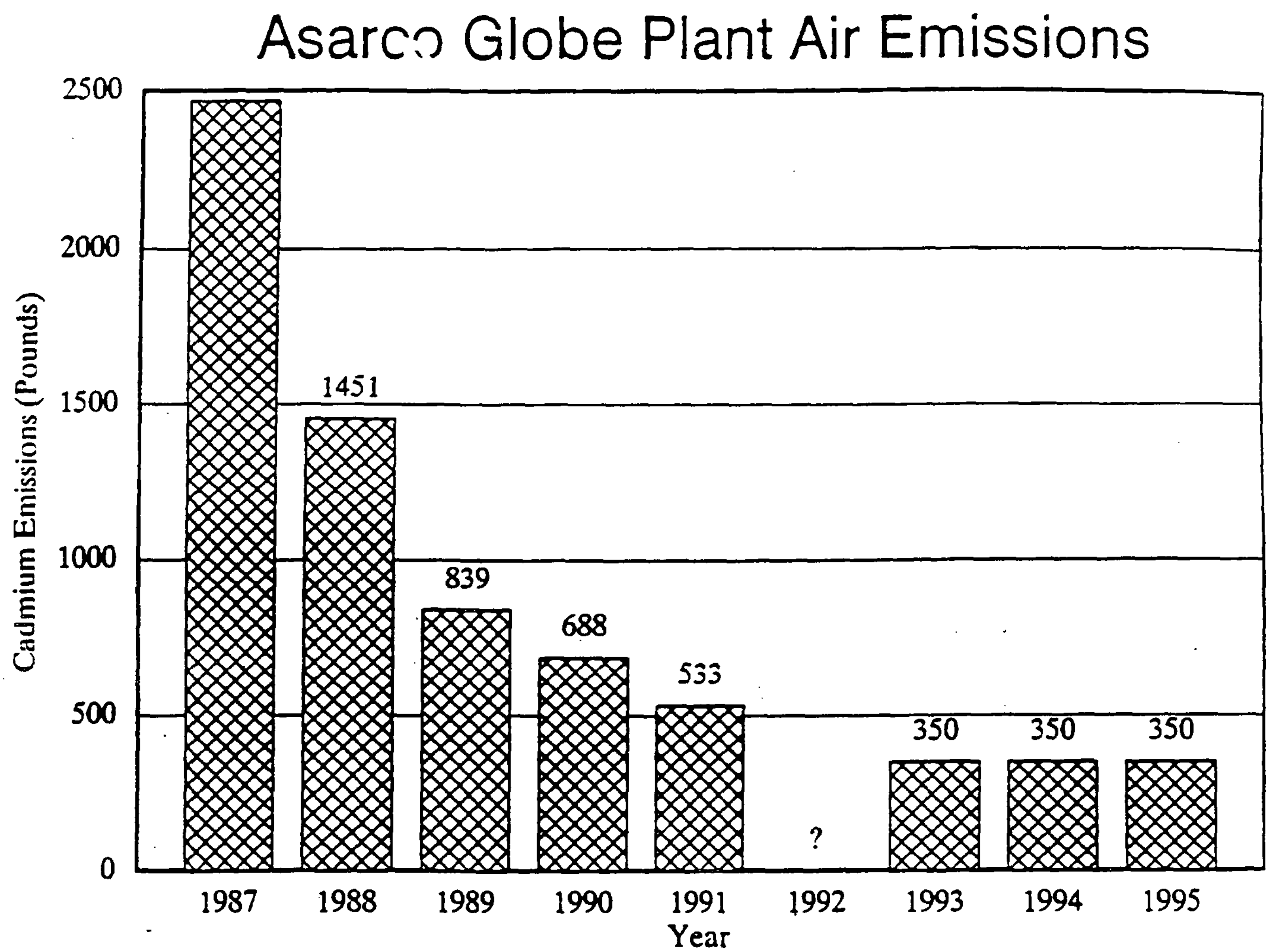
8 Retort Department:
Fugitive Emissions.
- Pre-1987 - Dust collector #2
- Current - Replaced by dust collector #4 & enclosed check weighing station
- Proposed - Secondary HEPA install.

9 Wastewater Treatment Plant
- Pre-1987 - None
- Current - Caustic scrubber
- Proposed - No additional controls

10-13 Litharge Department
- Pre-1987 - Dust collectors #1, #2, & #3
- Current - Added dust collector #4, modified storage, packing & weighing stations.
- Proposed - No additional controls

Figure 9 Point Source Air Emission Controls

Note: Secondary HEPA filters installed if feasible



Asarco Globe Plant Air Emissions
Cadmium Emissions (Pounds)
2500
2000
1500
1000
500
0
1451
839
688
533
?
350
350
350
1987
1988
1989
1990
1991
1992
1993
1994
1995
Year

The remedy does not include the thallium, indium, or cadmium sulfide processes. These processes are not currently operating; should they become operational, their contribution to Plant emissions will be analyzed and the controls available to minimize these emissions to health-protective levels will be evaluated.

Remedial measures for Plant site soils contaminated above the levels established to protect Plant site workers or trespassers will be of similar types as for off-Plant site soils. Worker/trespasser action levels are 9125 mg/kg for cadmium, 3000 mg/kg for lead, and 426 mg/kg for arsenic. Cover materials will include a minimum of an additional 12 inches of soils or gravel, or 2 inches of pavement. Soil areas above any soil action levels (including community soils and plant site soils action levels) will be vegetated or otherwise covered to prevent wind-blown soil movement. Additional topsoil, tilling, or soil additives will be applied in any areas that will not support vegetation such that vegetative cover can be established. Operational areas not conducive to vegetation (e.g., roads) will be paved. Adequate surface water controls will be provided to prevent erosion and/or contamination of surface water. Performance standards for percent vegetative cover, wind-blown dust emissions, and off-site sediment transport will be established. Additional capping, vegetative control, surface water control, or alternate remedial measures will be required if the corresponding standards were exceeded, after adequate time for repair has been allowed and proven ineffective.

Sediments from the on-site former sedimentation pond will be stabilized, re-deposited above the ground-water table, and capped with clay and suitable erosion protection. MCLs will be established as performance standards for ground water quality leaving the stabilized sediments.

Floors and sumps of Plant site process and storage buildings in wet operations will be sealed with an impermeable coating prior to sue. Secondary liners with leak detection capabilities would be provided for specified sumps. The state will review inspection records and documentation of: sump emptying and maintenance schedules; condition of tanks, sumps, and floors; condition of secondary containment and leak detection; working condition of spill controls and alarms; and spill release records.

A spill control pond will be constructed to contain spills from Plant operation.

Risk Reduction

Risk reductions are provided through covering soils contaminated above action levels and providing vegetation. Risk levels are reduced to a 1×10^{-5} excess cancer risk from exposure to arsenic in soils for Plant site workers, to a 4×10^{-6} excess cancer risk from arsenic for trespassers, and to health protective levels for cadmium, lead, and zinc exposures from Plant site soils. Risk reductions are also provided through preventing ground water contamination by stabilizing sediments and providing additional Plant site containment; and controlling spills and surface water runoff with the spill control pond.

This air emission controls provide risk reduction through additional capture of point source emissions from the Globe Plant processes and from a reduction in fugitive emissions. The emissions limitation would be expected to reduce the maximum risks due to cadmium and arsenic emissions to approximately 1×10^{-4} excess cancer risk as compared to a maximum risk of 4.2×10^{-3} excess cancer risk calculated in the PHE. If the HEPA pilot test shows that HEPAs are feasible at each source identified, risk reduction achie.ed through installation of HEPA filters could reduce risks down to approximately 1×10^{-5} excess cancer risk. After the HEPA pilot test and evaluation are complete, the air remedy will result in a cumulative site-wide hazard index less than or equal to one and a cumulative excess cancer risk of less than 1×10^{-4}.

Institutional Controls

Future use of the Plant site property will be restricted to industrial uses that involve similar or more restrictive exposure levels. Use controls will also require maintenance of vegetative cover and erosion control features.

Cost

Capital costs associated with the Plant site remedy are estimated to be $4,468,000. Costs for operation, maintenance, and long-term monitoring are estimated to be $466,000 per year. The present value cost over 30 years is $8,864,000. Pending pilot test evaluation, the potential additional present value cost of HEPA installation and operation may range up to $3,425,000.

STATUTORY DETERMINATIONS

Under CERCLA Section 121, CDH must select a remedy that is protective of human health and the environment, complies with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), is cost-effective, and utilizes permanent solutions to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principle element. The following sections present how the selected remedy meets these statutory requirements.

Protection of Human Health and the Environment

The selected remedy protects human health and the environment through a combination of ground water, surface water, soil, and air emission reduction activities. More detail regarding the engineering controls to be provided is included in the description of the selected remedy.

Former Neutralization Pond

For the Former Neutralization Pond materials, the multilayer cap, slurry wall, and ground water drain provide redundant protection by preventing leachate generation. Any contaminants migrating through this complex system will be captured using the slurry wall and drain system, and will ultimately be treated at the wastewater treatment plant. Capping of the materials will prevent direct human contact with the materials and wind-blowing of particles. The cap also provides long-term protection against surface water contacting the materials. In addition, the composite cap will prevent or minimize infiltration of precipitation into the materials thereby minimizing leachate production and subsequent migration into ground water. Waste materials will be isolated from the surrounding ground water by the combination of the slurry wall and ground water drain system, thus preventing migration of contaminants into the surrounding ground water. The ground water drain system minimizes maintenance requirements for extraction of ground water. Construction methods that prevent generation of wind-blown particulates will be used to minimize short-term risks and cross-media impacts. OSHA requirements for workers on hazardous sites will be followed.

Ground Water and Surface Water

Extracting and treating ground water on the terrace aquifer and the highly contaminated area of the floodplain aquifer will reduce, and eventually eliminate, the potential threats to human health from contaminants in ground water. Institutional controls will be implemented to ensure protectiveness. Risk reduction will be achieved in the interim through prevention of ground water use through institutional controls and will be provided by long-term restoration of terrace and floodplain ground water through source control, extraction and treatment on the terrace and natural attenuation in the floodplain. Carcinogenic and non-carcinogenic risk associated with contaminated IDD sediments will be removed through removal of the sediments. Risk reduction for the detention pond is achieved through prevention of contact or removal of the detention pond sediments if the sediments become exposed. No unacceptable short-term risks or cross-media impacts are expected due to implementation of the remedy. OSHA requirements will apply to construction activities and will be followed.

Community Soils

The community soil and vegetable garden remedy will reduce carcinogenic risks to within the NCP risk range (10^{-4} to 10^{-6} excess cancer risk) and will result in health protective levels for non-carcinogens (systemic toxicants). The required arsenic action level, 70 mg/kg, is equivalent to a 8.0×10^{-5} excess cancer risk based on RAGS methodology. The FS estimated excess cancer risk level was 5.8×10^{-5} based on SPHEM methodology. This represents a reduction from the maximum risk due to ingestion of community soil of 9.2×10^{-3} calculated in the PHE. Remediation within the voluntary buffer zone would achieve an excess cancer risk due to arsenic exposure of 3.0×10^{-5} excess cancer risk based on RAGS methodology. The cadmium action level is based upon a health protective level, with the cadmium action level of 73 mg/kg equivalent to a hazard index of 0.69 (including vegetable ingestion) based on RAGS methodology. This compares to a maximum hazard index of 273 calculated in the PHE. The lead action level of 500 mg/kg is based upon EPA's OSWER Directive #9355.4-02 that sets an interim soil cleanup level for total lead at 500 to 1000 ppm. In vegetable gardens, the zinc action level of 500 mg/kg is based upon plant phytotoxicity. Risk reductions are achieved through removal, covering, or deep tilling of contaminated soils. Because soils will be replaced by or covered with clean soils with metals concentrations lower than the selected action levels, actual risk reductions will be greater than those stated above. Construction practices, such as minimizing working areas, watering excavated areas and roads to prevent windblown dust, and immediately establishing vegetation, will be used to minimize short-term risks and cross-media impacts caused by implementation of the remedy. OSHA requirements will apply to construction activities and will be followed.

Plant Site

A variety of engineering controls will be implemented on the Plant property that will reduce or eliminate impacts to human health and the environment. Airborne cadmium and arsenic emissions will be reduced to achieve protective ambient levels in the community by implementing sophisticated point source emission controls in combination with emission limitations and reduction in fugitive emissions. The air emission controls provide risk reduction through additional capture of point source emissions from the Globe Plant processes and from a reduction in fugitive emissions. The emissions limitation will reduce the maximum risks due to cadmium and arsenic emissions to approximately 9×10^{-5} excess cancer risk as compared to a maximum risk of 4.2×10^{-3} excess cancer risk calculated in the PHE. If the HEPA pilot test shows that HEPAs are feasible at each source identified, risk reduction achieved through installation of HEPA filters could reduce risks down to approximately a $1x10^{-5}$ excess cancer risk. After the HEPA pilot test is completed, evaluation of the results will include performance of a concurrent risk assessment. This risk assessment will utilize any EPA interim or final reference concentration values, as well as source apportionment. Additional emission limitations will be required that at a minimum, provide a protective overall site remedy (within the risk range and with a cumulative hazard index less than or equal to one).

Risk reductions are provided through covering soils contaminated above action levels and providing vegetation. Risk levels are reduced to a $1x10^{-5}$ excess cancer risk from exposure to arsenic in soils for Plant site workers, to a $4x10^{-6}$ excess cancer risk from arsenic for trespassers, and to health protective levels for cadmium, lead, and zinc exposures from Plant site soils. Risk reductions are also provided through preventing ground water contamination by stabilizing sediments and providing additional Plant site containment; and controlling spills and surface water runoff with the spill control pond. Vegetative cover, erosion control, and institutional controls will insure that Plant site soils and community soils placed on the Plant site will not cause unacceptable health risks in the community due to re-entrained dust.

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The selected remedy will comply with all applicable or relevant and appropriate requirements. No waiver of ARARs is necessary.

Contaminant-specific ARARs typically set levels or concentrations of chemicals that are found in or discharged to the environment. Location-specific ARARs establish requirements or limitations based on the physical or geographical setting of the site or protected resources on the site. Action-specific ARARs are those regulations or requirements that pertain to the remedial actions undertaken.

Former Neutralization Pond ARARs

The primary ARARs for the Former Neutralization Pond include the RCRA Subtitle C regulations for interim status facilities. In order to meet ARARs, the Former Neutralization Pond remedy must meet the Colorado hazardous waste requirements of 6 CCR 1007. Subpart F specifies ground water monitoring requirements. Subpart G, Sections 265.110 - 265.120, specifies closure and post closure requirements for interim status facilities. Section 265.111 gives general closure performance standards for these facilities. Under 265.111, the owner/operator must close his facility in a manner that a) minimizes the need for further maintenance; b) controls, minimizes or eliminates . . . the post-closure escape of hazardous constituents, leachate, . . . to waters or atmosphere; and

c) complies with specific closure requirements for tanks, waste piles, surface impoundments, landfills, as applicable. Subpart N details requirements for landfills.

The Former Neutralization Pond remedy includes a complex multi-layer cap to be designed and installed in accordance with EPA guidance (Design and Construction of RCRA/CERCLA Final Covers, EPA, 1990). The cap and the surrounding slurry wall will require minimal maintenance and will minimize the escape of hazardous constituents or leachate to the adjacent ground water or atmosphere. With the addition of the gravity drain system, inward gradients will be maintained to eliminate the post-closure escape of hazardous constituents or leachate. The drain collects contaminated ground water from within the slurry wall for subsequent treatment at the Plant wastewater treatment Plant. Through time, concentrations in the collected ground water will decline such that the requirement for further maintenance is minimized. A ground water monitoring program will be provided.

Subpart N, Section 265.312 specifies requirements for closure and post-closure care. Closure requirements include a final cover designed and constructed to: (1) provide long-term minimization of migration of liquids through the landfill; (2) function with minimum maintenance; (3) promote drainage and minimize erosion or abrasion of the cover; (4) accommodate settling and subsidence; and (5) have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Post-closure requirements include monitoring, maintenance, surface water control, planning, and notification requirements. The selected remedy will comply with these requirements.

Any excavated materials that are characterized as hazardous through use of the TCLP test will be managed as hazardous wastes subject to RCRA Subtitle C regulations, including RCRA land disposal restrictions. Any collected ground water will be treated as described above. The ARARs for the Former Neutralization Pond remedy are presented in Table 13.

Table 13
Former Neutralization Pond Operable Unit

CHEMICAL-SPECIFIC ARARS	
Colorado Hazardous Waste Management Regulations 6 CCR 1007-3, part 261, Identification of hazardous waste.	Materials in the neutralization pond were characterized as hazardous using the EP toxicity test during the RI. TCLP testing will be used to characterize any excavated materials. Will be achieved.
National Primary and Secondary National Ambient Air Quality Standards 40 C.F.R part 50.6, for particulate matter less than 10 microns; primary and secondary standard: 50 ug/m^3 annual arithmetic mean, 150 ug/m^3 24-hour standard (PM10)	The entire Denver metropolitan area has been determined to exceed the standard with a probability of greater than or equal to 95 percent. The area is designated as a Group 1 area.
National Primary and Secondary Ambient Air Quality Standard 40 C.F.R. part 50.12 For lead in ambient air. Quarterly (3-month) average concentration must be less than 1.5 ug/m^3.	Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-14 (ambient air standard for Total Suspended Particulate Matter; primary standard: 75 ug/m^3 annual geometric mean, 260 ug/m^3 24-hour standard; secondary standard 60 ug/m^3 annual geometric mean, 150 ug/m^3 24-hour standard.	The entire Denver metropolitan area regularly exceeds these standards, and is considered to be a "non-attainment area" for these parameters.
Colorado Air Quality Control Regulations, 5 CCR 1001-10, Regulation 8. (ambient air standard for lead; monthly average concentration must be less than 1.5 ug/m^3).	Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-10, Regulation 8. (Emission standards for mercury and beryllium).	Will be achieved.
ACTION-SPECIFIC ARARS	
1. Colorado Solid and Hazardous Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, solid waste provisions	Will be achieved for any materials excavated and disposed of on-site.

a. §2.1-2.4 (minimum design and operation standards requiring compliance with all health, air and water laws, prevention of odors and other nuisances, surface water diversion, ground water monitoring, prohibition against receiving hazardous waste unless authorized, inspection and closure requirements)	Will be achieved.
b. §4 (site and design standards and data requirements for new facilities)	Will be achieved for any new disposal facility on-site.
2. Colorado Solid and Hazardous Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, part 2, Hazardous Waste Provisions	
a. §§2.4.1-2.4.5 (design facility to prevent long-term adverse effects on ground water, surface water, air quality, public health, and the environment)	Will be achieved.
b. §2.4.7 (design runoff and leachate control system sufficient to prevent adverse effects on ground water surface water, air quality, public health, and the environment)	Will be achieved.
c. § 2.4.8 (close facility to assure long-term compliance with §§ 2.4.1-2.4.5 and 2.4.7	Will be achieved.
d. §§2.4.9 and 2.4.10 (monitor ground and surface water; provide quality control during construction)	Will be achieved.
e. §§2.5.1, 2.5.2 and 2.5.6 (design to assure compliance with criteria of § 2.4; design to assure odor control, fire protection, site security, protective operation)	Will be achieved.
f. §2.5.3 (geological and hydrological conditions of a site in which hazardous wastes are to be disposed shall be such that reasonable assurance is provided that such wastes are isolated within the designated disposal area of the site and away from natural environmental pathways that could expose the public for 1,000 years, or some demonstrated shorter period in which the wastes are transformed to an innocuous condition)	Will be achieved for materials excavated and disposed on-site.
g. §§2.5.4 and 2.5.5 (design requirements for liner and leachate and runoff control system)	Will be achieved.
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 262 (standards applicable to generators of hazardous waste)	Will be achieved for any hazardous wastes generated during remedial actions.

4. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 263 (standards applicable to transporters of hazardous waste)	Will be achieved for any wastes that are transported outside of the area of contamination.
5. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 264 (standards for owners and operators of hazardous waste treatment, storage, and disposal facilities)	
a. Subpart F (ground water protection standards including monitoring requirements)	Will be achieved.
b. Subpart G (closure and post-closure) including §264.111 (closure to minimize maintenance and control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere)	Will be achieved.
c. Subpart N (requirements for landfills) including § 264.310 (final cover designed and constructed to minimize migration of liquids through landfill, require minimum maintenance, have permeability less than or equal to permeability of bottom liner system or natural soils, collect leachate until no longer detected and prevent erosion from run-on and run-off)	Will be achieved.
6. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3 part 265 (standards for owners and operators of interim status hazardous waste treatment, storage, and disposal facilities	
a. Subparts B-E (facility standards, preparedness, emergency planning, record keeping and reporting)	Substantive requirements will be achieved.
b. Subpart F (groundwater protection standards including monitoring requirements)	Will be achieved.
c. Subpart G (closure and post-closure) including § 265.111 (closure to minimize maintenance and control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere	Will be achieved.

d. Subpart N (requirements for closing landfills) including § 265.310 (final cover designed and constructed to minimize migration of liquids through landfill, require minimum maintenance, have permeability less than or equal to permeability of bottom liner system or natural soils, collect leachate until no longer detected, and prevent erosion from run-on and run-off)	Will be achieved.
7. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	Will be achieved for any hazardous wastes transported.
8. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	Will be achieved for any hazardous wastes transported.
9. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (land disposal restrictions for third scheduled wastes)	Will be achieved for any hazardous wastes excavated and redisposed in a separate area of contamination.
10. Colorado Air Quality Control Regulations, 5 CCR 1001, (Regulation 1, Section III(D)), 1001-14	Will be achieved.
11. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989)	Will be achieved.
12. 2 CCR 402-2. Water Well and Pump Installation Construction Regulations. Establishes regulations for construction and abandonment of wells.	Will be achieved.
13. Colorado Air Quality Control Regulations, 5 CCR 1001-3, Regulation 1. (Establishes emission control regulations and opacity standards for particulate matter; requires minimization of fugitive particulate emissions from construction activities; requires submission of fugitive particulate emission control plan).	Will be achieved.
14. Colorado Air Quality Control Regulations, 5 CCR 1001-4, Regulation 2. (Establishes odor emission regulations. Systems to be designed to provide odor-free operation).	Will be achieved.

15. Colorado Air Quality Control Regulations, 5 CCR 1001-5, Regulation 3. (Requires analysis of air pollution impacts prior to start of project; Air Pollution Emission Notice (APEN) to be filed; source cannot cause an exceedance in any attainment area of any National Ambient Air Quality standard; source cannot interfere with attainment and maintenance of any state ambient air quality standard; source to undergo review procedure which estimates public health impacts from toxic pollutants).	Will be achieved, except for state and federal standards for particulate matter. The particulate matter standards are routinely exceeded throughout the Denver Metropolitan area.
LOCATION-SPECIFIC ARARS	
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, §264.18 (disposal facility may not be located close to a fault or in 100-year floodplain)	Will be achieved.

Ground Water and Surface Water ARARs

Primary chemical-specific ARARs for the Ground Water and Surface Water Operable Unit include the Safe Drinking Water Act Maximum Contaminant Levels (SDWA MCLs) for cadmium, arsenic, lead, and zinc; Clean Water Act water quality standards for the South Platte River Section 15; and Colorado Water Quality Control agricultural standards. The MCLGs for arsenic and cadmium are also relevant and appropriate to the ground water remedy, however, they are equivalent to the MCLs for these substances. The MCLG for lead is zero and is not appropriate for use as an ARAR. The interim narrative standards for ground water within the saturated zone of the unconfined portions of the Denver Basin Aquifer system are applicable and are the less restrictive of the existing ambient quality as of October 30, 1991, or 0.01 mg/l for cadmium, 0.01 mg/l for arsenic, 0.05 mg/l for lead, and 2.0 mg/l for zinc.

Action-specific requirements include treatment requirements for collected ground water. These may include requirements for pretreatment and discharge to publicly owned treatment works, standards for direct discharge to surface water, or MCLs, depending on discharge specifics. Action-specific ARARs for air impacts from construction and ground water treatment, and management of any hazardous wastes generated, are as described in Table 13, above. Location-specific ARARs include a prohibition on well construction into contaminated ground water, contained in Rule 10.2.2 of the state of Colorado's Office of State Engineer, State Board of Examiners of Water Well Construction and Pump Installation Contractors.

ARARs for the Ground Water and Surface Water remedy are described in Table 14.

Table 14
Ground and Surface Water Operable Unit

CHEMICAL-SPECIFIC ARARS	
Cadmium	
1. SDWA primary MCL(1) (0.005 mg/l) and MCLG (0.005 mg/l) 40 C.F.R. §141.62	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in flood-plain ground water in approximately 100 years.
2. Colorado Water Quality Control Agricultural Standard, (2) and Clean Water Act Water Quality Criterium for Human Health (3) (.01 mg/l)	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in flood-plain ground water in approximately 100 years.
3. South Platte River Stream Standard (4) $e^{(1.128[\ln(\text{hardness})]-2.905)}$ (acute standard for aquatic life uses); $e^{(.7852[\ln(\text{hardness})]-3.490)}$ (chronic standard for aquatic life uses); 10 ug/l (30-day) (standard for agriculture uses); or 10 ug/l (1-day) (standard for drinking water uses). 5 CCR 1002-8 §3.8.6, Upper South Platte River Basin, stream segment 15.	Will be achieved.
4. Interim narrative standard for ground water within the saturated zone of the unconfined portions of the Denver Basin Aquifer system is the less restrictive of the existing ambient quality as of October 30, 1991, or .01 mg/l. 5 CCR 1002-8 § 3.12.5	Will be achieved.
Arsenic	
1. SDWA primary MCL (1) (.05 mg/l) and MCLG (0.05 mg/l)	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in flood-plain ground water in approximately 100 years.
2.Colorado Water Quality Control Agricultural Standard (2) (.10 mg/l)	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will take approximately 30 years to achieve in terrace ground water and approximately 100 years to achieve in flood plain ground water.

3. South Platte River Stream Standard (4) 50(Trec). 5 CCR 1002-8 § 3.8.6, Upper South Platte River Basin, stream segment 15.	Will be achieved.
4. Interim narrative standard for ground water within the saturated zone of the unconfined portions of the Denver Basin Aquifer system is the less restrictive of the existing ambient quality as of October 30, 1991, or 0.05 mg/l. 5 CCR 1002-8 § 3.12.5.	Will be achieved.
Lead	
1. SDWA primary MCL (1) - 0.05 mg/l	Will be achieved, since standard not currently exceeded in ground water or surface water.
2. Colorado Water Quality Control Agricultural Standard (2) (.10 mg/l)	Will be achieved, since standard not currently exceeded in ground water or surface water.
3. South Platte River Stream Standard $(1/2)e^{(1.6148[\ln(\text{hardness})]-2.1805}$ (acute standard for aquatic life uses); $e^{(1.417[\ln(\text{hardness})]-5.176}$ (chronic standard for aquatic life uses; 100 ug/l (30-day) (standard for agriculture uses); or 50 ug/l (1-day) (standard for drinking water uses) 5 CCR 1002-8 §3.8.6, Upper South Platte River Basin, stream segment 15.	Will be achieved.
4. Interim narrative standard for ground water within the saturated zone of the unconfined portions of the Denver Basin aquifer system is the less restrictive of the existing ambient quality as of October 30, 1991, or .05 mg/l. 5 CCR 1002-8 §3.12.5.	Will be achieved.
Zinc	
1. SDWA Secondary MCL (1) (5 mg/l) and Clean Water Act Water Quality Criteria for Human Health (3) (5 mg/l)	Farmers and Gardeners Ditch and floodplain ground water: Standard not currently exceeded. Terrace ground water: will meet in approximately 30 years. Industrial Drainage Ditch: will meet.
2. Colorado Water Quality Control Agricultural Standard (2) (2 mg/l)	Farmers and Gardeners Ditch and floodplain: Standard not currently exceeded. Terrace ground water: will meet in approximately 30 years. Industrial Drainage Ditch will meet.

3. South Platte River Stream Standard $(1/2)e^{(.809[\ln(hardness)]+2.351)}$ (acute standard for aquatic life uses); $e^{(1.924[\ln(hardness)]-6.393)}$ (chronic standard for aquatic life uses if hardness is greater than 200 mg/l); 45 mg/l (chronic standard for aquatic life uses if hardness is less than or equal to 200 mg/l); 2000 ug/l (30-day) (standard for agriculture uses); or 5000 ug/l (30-day) (standard for drinking water uses). 5 CCR 1002-8 §3.8.6, Upper south Platte River Basin, stream segment 15.	Will be achieved.
4. Interim narrative standard for ground water within the saturated zone of the unconfined portions of the Denver Basin Aquifer system is the less restrictive of the existing ambient quality as of October 30, 1991, or 2.0 mg/l. 5 CCR 1002-8 §3.12.5.	Will be achieved.
Other	
Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of Hazardous Waste	Any excavated materials meeting characteristics of [TCLP] will be handled and disposed of in accordance with hazardous waste requirements.
ACTION-SPECIFIC ARARS	
1. Colorado Water Quality Control Act and Regulations	
a. Standards and requirements for pretreatment and discharge to POTW, 5 CCR 1002-20	Will be achieved.
b. Standards and requirements for direct discharge to surface water, 5 CCR 1002-8	Will be achieved.
2. Clean Water Act dredge and fill requirements, 40 C.F.R. parts 230, 231; 33 C.F.R. part 323	Will be achieved for any areas determined to be wetlands.
3. Underground Injection Control requirements, 40 C.F.R. parts 144-147	Will be achieved.
4. Colorado Noise Abatement Statute, §§ 25-12-1-1 to 103, C.R.S. (1989) (noise limitations for construction activities)	Will be achieved.
5. Colorado Air Quality Control Regulations, 5 CCR 1001-3 (Regulation 1 Section III(D)), 5 CCR 1001-14	Will be achieved.
7. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107,171-177	Will be achieved.

8. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (land disposal restrictions for third scheduled wastes)	Will be achieved for wastes subject to these restrictions.
9. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	Will be achieved for materials meeting characteristics of [TCLP]
10. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	Will be achieved for materials meeting characteristics of [TCLP]
11. Colorado Water Rights and Irrigations Laws, see §§ 37-82	Will be achieved.
12. 2 CCR 402-2. Water Well and pump Installation Contractors Regulations	Will be achieved.
13. Colorado Air Quality Control Regulations, 5 CCR 1001-9, Regulation No. 7. (Section V requires that Reasonably Available Control Technology be utilized when volatile organic compounds are disposed of by evaporation).	Section V could potentially apply to excavation of IDD and Detention Pond sediments. Will be achieved.
14. Criteria for municipal solid waste landfills. 56 F.R. 59978, October 9, 1991 (codified at 40 C.F.R. § 258.	Will be achieved when managing solid wastes.
LOCATION-SPECIFIC ARARS	
1. State of Colorado's Office of State Engineer, State Board of Examiners of Water Well Construction and Pump Installation Contractors (revised effective July 30, 1988), Rule 10.2.2	Will be achieved.
2. E.O. #11990 40 C.F.R. Section 6.302(a) and Appendix A, Protection of Wetlands.	Will be achieved.
3. E.O. #11988 40 C.F.R. Section 6.302(b) and Appendix A, Floodplain Management.	Will be achieved.

TBCs	
1. Safe Drinking Water Act Health Advisories, EPA, Office of Drinking Water Advisory, April, 1992	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will take less time to achieve SDWA Health Advisory than primary MCL in terrace ground water.
2. Management of contaminated materials at regulated underground storage tank ("UST") facilities. UST Owner/Operator Guidance Documents for Investigation, Corrective Action, Use of State Cleanup Action Levels and Management of Contaminated Materials, Colorado Department of Health, March 1, 1991.	Guidance will be considered when managing contaminated materials.
4. Local (Denver and Adams County) floodplain management ordinances.	Will be considered if construction activities are conducted in floodplain.

Footnotes to table of ARARs for Ground Water and Surface Water Operable Unit

1. Safe Drinking Water Act (SDWA) primary and secondary Maximum Contaminant Levels (MCLs), 40 C.F.R. 141.11 and 143.3. The MCL for cadmium is more stringent than and the MCLs for arsenic and lead are equal to the contaminant levels established under Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 264 § 264.94.

2. Colorado Water Quality Control Standard - Agricultural Standards, 5 CCR 1002-8.

3. Clean Water Act (CWA), 33 U.S.C. §§ 1251 to 1376, Water Quality Criteria For Human Health, 51 Fed. Reg. 43,665 (1986).

4. Colorado Water Quality Control Stream Standards -- Standards for Segment 15 of the South Platte River, 5 CCR 1002-8, § 3.8.6 (2), effective July 30, 1992.

5. Safe Drinking Water Act Health Advisories, EPA, Office of Drinking Water Advisory, March 31, 1987.

Community Soils ARARs

Chemical-specific ARARs for the Community Soils Operable Unit include the requirements for identification and management of hazardous waste, detailed more fully in Table 13, above. Action-specific ARARs for air impacts from community soils construction activities and management of any characteristic hazardous wastes are also described in Table 13, above. Additional ARARs that pertain to the Community Soils remedy are described in Table 15.

Table 15
Community Soils and Vegetable Gardens Operable Unit

CHEMICAL-SPECIFIC ARARS	
Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of Hazardous Waste	Excavated materials meeting TCLP characteristics will be handled and disposed of in accordance with hazardous waste requirements.
ACTION-SPECIFIC ARARS	
1. Colorado Air Quality Control Regulations, 5 CCR 1001-3 (Regulation 1, Section III(D)), 5 CCR 1001-14	Will be achieved.
2. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	Will be achieved.
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	Will be achieved for materials meeting TCLP characteristics.
4. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	Will be achieved.
5. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	Will be achieved.
6. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) land disposal restriction for third scheduled wastes	Will be achieved for wastes subject to these restrictions.
7. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989) (noise limitations for construction activities)	Will be achieved.
8. Criteria for municipal solid waste landfills. 56 F.R. 50978, October 9, 1991 (codified at 40 C.F.R. § 258.	Will be achieved when managing solid wastes.
9. Clean Water Act, dredge and fill requirements, 40 C.F.R. parts 230, 231; 33 C.F.R. part 323	Will be achieved for any areas determined to be wetlands.
LOCATION-SPECIFIC ARARS	
1. E.O. #11990 40 C.F.R. Section 6.302(a) and Appendix A, Protection of Wetlands.	Will be achieved.
2. E.O. #11988 40 C.F.R. Section 6.302(b) and Appendix A, Floodplain Management.	Will be achieved.

TBCs	
Management of contaminated materials at regulated underground storage tank ("UST") facilities. UST Owner/Operator Guidance Documents for Investigation, Corrective Action, Use of State Cleanup Action Levels and Management of Contaminated Materials, Colorado Department of Health, March 1, 1991.	Will be considered in management of contaminated materials.
Local floodplain management ordinances (Denver and Adams County).	Will be considered for any construction activities taking place in the floodplain.

Plant Site ARARs

Chemical-specific ARARs for Plant site ground water include those described for the Ground Water and Surface Water Operable Unit in Table 14. Chemical-specific ARARs also include those described in Table 17, for the Air Emissions portion of the Plant Site Operable Unit. Chemical-specific and action-specific ARARs for Plant site soils are the same as those described in the Community Soils Operable Unit, Table 15. In addition, action-specific ARARs that pertain to air impacts from Plant site construction activities are described in Table 13, above. ARARs that pertain to the Plant site are described in Tables 16 and 17.

Table 16
Globe Plant Site Operable Unit

CHEMICAL-SPECIFIC ARARS	
1. Colorado Air Quality Control Regulations, 5 CCR 1001-10 (ambient air standard for lead, 1.5 ug/m3 monthly average)	Will be achieved.
2. Colorado Air Quality Control Regulations, 5 CCR 1001-14 (ambient air standard for Total Suspended Particulates; primary standard: 75 ug/m3 annual geometric mean, 260 ug/m3 24 hour standard; secondary standard: 60 ug/m3 annual geometric mean, 150 ug/m3 24 hour standard	The entire Denver metropolitan area regularly exceeds these standards, and is considered to be a "non-attainment area" for these parameters.
3. National Primary and Secondary Ambient Air Quality Standard 40 C.F.R part 50.6, for particulate matter less than 10 microns; primary and secondary standard: 50 ug/m3 annual arithmetic mean, 150 ug/m3 24 hour standard (PM10)	The entire Denver metropolitan area has been determined to exceed the standard with a probability of greater than or equal to 95 percent. The area is designated as Group I area.

4. Colorado Air Quality Control Regulations, 5 CCR 1001-10. (Standards for control of asbestos).	Applicable if building modifications require disturbance of asbestos-containing materials. Will be achieved.
5. Colorado Air Quality Control Regulations, 5 CCR 1001-10 (Standards for H_2S).	Will be achieved.
6. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of Hazardous Waste	Waste materials meeting TCLP characteristics will be handled in accordance with hazardous waste requirements.
ACTION-SPECIFIC ARARS	
1. Colorado Air Quality Control Regulations, 5 CCR 1001-3, Regulation 1, Section III(D), 5 CCR 1001-14, 5 CCR 1001-5, Regulation 3, Section II[2]	Will be achieved.
2. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	Will be achieved for materials managed on-site. CERCLA requires that in the case of any response action involving the transfer of a hazardous substance offsite, the hazardous substance may only be transferred to a facility that complies with §§ 3004 and 3005 of the Solid Waste Disposal Act and all other applicable federal law and all applicable state requirements.
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	Will be achieved for all substantive requirements if waste materials are TCLP characteristic.
4. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	Will be achieved.
5. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	Will be achieved.
6. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (land disposal restrictions for third scheduled wastes)	Will be achieved for wastes subject to these restrictions.
7. Federal Clean Water Act Nonpoint Source Control Requirements, 33 U.S.C. § 1314(e); 40 C.F.R. 125 (K)	Will be achieved.
8. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989) (noise limitations for construction activities)	Will be achieved.
9. Standards for Performance for New Stationary Sources, 40 CFR 60.	Portions of these standards may be relevant and appropriate if plant facilities are similar to NSPS sources.

10. Colorado Air Quality Control Regulations, 5 CCR 1001-8, Regulation 6. (standards for Performance for New Stationary Sources, State Regulation).	Portions of these standards may be relevant and appropriate if plant facilities are similar to NSPS sources.
11. National Emission Standards for Hazardous Air Pollutants, 40 CFR 61.	Although not strictly applicable to this source, portions regarding beryllium and arsenic may be re'-vant and appropriate, especially housekeeping, recordkeeping, and control equipment provisions found in Subparts N, O, and P.
12. CDPS Storm Water Discharges Associated with Industrial Activity Regulations.	Will be achieved.
13. 40 C.F.R. Part 122, 123, 124. Industrial and Construction Storm-water Discharge Regulations.	Will be achieved.
14. Criteria for municipal solid waste landfills. 56 F.R. 50978, October 9, 1991 (to be codified at 40 C.F.R.§ 258)	Will be achieved for management of solid wastes (contaminated soils).
LOCATION-SPECIFIC ARARS	
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, §264.18 (disposal facility may not be located close to a fault or in 100-year floodplain)	Will be achieved for any hazardous wasted disposed of on site.
2. E.O. #11990 40 C.F.R. Section 6.302(a) and Appendix A, Protection of Wetlands.	Will be achieved.
3. E.O. #11988 40 C.F.R. Section 6.302(b) and Appendix A, Floodplain Management.	Will be achieved.
TBCs	
1. Management of contaminated materials at regulated underground storage tank ("UST") facilities. UST Owner/Operator Guidance Documents for Investigation, corrective Action, Use of State Cleanup Action Levels and Management of Contaminated Materials, Colorado Department of Health, March 1, 1991.	Will be considered for management of contaminated materials.

Table 17
Globe Point Source Air Emissions

CHEMICAL-SPECIFIC ARARS	
National Primary and Secondary Ambient Air Quality Standard 40 CFR part 50.6, for particulate matter less than 10 microns; primary and secondary standard: 50 ug/m^3 annual arithmetic mean, 150 ug/m^3 24-hour standard (PM10)	The entire Denver metropolitan area has been determined to exceed the standard with a probability of greater than or equal to 95 percent. The area is designated as a Group I area.
National Primary and Secondary Ambient Air Quality Standard 40 CFR Part 50.12, for lead in ambient air. Quarterly calendar average concentration must be less than 1.5 ug/m^3.	Will be achieved.
Colorado Air Quality Control Regulations,5 CCR 1001-14 (ambient air standard for Total Suspended Particulate matter; primary standard 75 ug/m^3 annual geometric mean, 260 ug/m^3 24-hour standard, secondary standard: 60 ug/m^3 annual geometric mean, 150 ug/m^3 24-hour standard.	The entire Denver metropolitan area regularly exceeds these standards, and is considered to be a "non-attainment area" for these parameters.
Colorado Air Quality Control Regulations, 5 CCR 1001-10, Regulation 8. (Ambient air standard for lead; monthly average concentration must be less than 1.5 ug/m^3)	Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-10, Regulation 8 (emission or ambient standards for beryllium; emission standard for mercury).	Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-10, Regulation 8. (standards for control of asbestos).	Applicable if building modifications require disturbance of asbestos-containing materials. Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-10 (standards for H_2S).	Will be achieved.
Colorado Air Pollution Prevention and Control Act, Section 25-7-109. {Comply with Colorado Generally Available Control Technology (GACT), or Maximum Achievable Control Technology (MACT)}.	If future regulations are developed for these source types, they will be complied with. This applies to GACT, MACT, or residual risk requirements.
Colorado Air Quality Control Regulations, 5 CCR 1001-3, Regulation 1. (Establishes emission control regulations and opacity standards for particulate matter; sets opacity standards).	Will be achieved.

Colorado Air Pollution Prevention and Control Act, Common Provision Regulations, 5 CCR 1001-2. (Requirements for stack testing, performance tests, recordkeeping, and reporting of emissions monitoring. Forbids circumvention of emission control devices).	Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-4, Regulation 2. (Establishes odor emission regulations. Systems to be designed to provide odor-free operation).	Will be achieved.
Colorado Air Quality Control Regulations, 5 CCR 1001-5, Regulation 3. (Requires analysis of air pollution impacts prior to start of project; Air Pollution Emission Notice (APEN) to be filed; source cannot cause an exceedance in any attainment area of any National Ambient Air Quality Standard; source cannot interfere with attainment and maintenance of any state ambient air quality standard; source to undergo review procedure which estimates public health impacts from toxic pollutants).	Will be achieved, except for state and federal standards for particulate matter. The particulate matter standards are routinely exceeded throughout the Denver metropolitan area.
Standards for Performance for New Stationary Sources, 40 CFR 60.	Portions of these standards may be relevant and appropriate if plant facilities are similar to NSPS sources.
Colorado Air Quality Control Regulations, 5 CCR 1001-8, Regulation 6. (Standards for Performance for New Stationary Sources, State Regulation).	Portions of these standards may be relevant and appropriate if plant facilities are similar to NSPS sources.
National Emission Standards for Hazardous Air Pollutants, 40 CFR 61.	Although not strictly applicable to this source,portions regarding beryllium and arsenic may be relevant and appropriate, especially housekeeping, recordkeeping, and control equipment provisions found in subparts N, O, and P.

1. Colorado Air Pollution Prevention and Control Act, Section 25-7-109. (Comply with Colorado Generally Available Control Technology (GACT), or Maximum Achievable Control Technology (MACT). If future regulations are developed for these source types, they will be complied with. This applies to GACT, MACT, or residual risk requirements.

2. The Colorado Air Quality Control Regulations, 5 CCR 1001-10 contain an ambient air standard for lead, of 1.5 ug/m3 on a monthly average. The federal ambient air standard for lead, 1.5 ug/m^3 on an annual average, is also an ARAR but is less stringent.

Cost Effectiveness

The selected remedy is cost-effective in mitigating the principal threats posed by the site. Cost-effectiveness is determined by evaluating the following three balancing criteria to determine overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective.

The selected remedies provide the best overall effectiveness of all alternatives considered proportional to its cost. The selected remedies will provide long-term effectiveness and permanence by minimizing or eliminating the contaminants that leach into ground water from the neutralization pond; by cutting off contaminated ground water flow from the floodplain; by removing or covering contaminated community and Plant site soils and sediments; by cutting off Plant site sources of ground water contamination; and by further reducing the emissions from the on-going Plant operations. The selected remedies reduce toxicity, mobility, and volume through treatment by treating collected contaminated ground water from the Former Neutralization Pond and from the terrace drain; by stabilizing contaminated sediments as necessary; and by removing additional air pollutants from Plant emissions. Short-term risks will be controlled through use of good construction practices and institutional controls.

Alternatives 7 and 8 for the Former Neutralization Pond operable unit would also provide high overall effectiveness. However, these alternatives are significantly more expensive than the selected remedy. In addition, Alternative 8 involves off-site disposal, which is disfavored by CERCLA when practicable on-site technologies exist. For the ground water remedy, Alternative 9 would result in ground water restoration in the floodplain in a faster time frame. Again, this alternative is significantly more expensive. In addition, there is uncertainty regarding the ability of floodplain ground water extraction and treatment to completely restore floodplain ground water to levels below drinking water standards. Because the ground water in the contaminated plume (1) is not currently being used and is not expected to be used as a drinking water source; (2) will be prohibited from being used as a drinking water source in the future; and (3) currently discharges to the Platte River and will not increase in area of contamination; the effectiveness gained by the additional costs for active remediation in the floodplain is questionable.

Preference for Permanent Solutions and Alternative Treatment Technologies

Where possible, the selected remedies satisfy the statutory preference for utilization of permanent solutions and alternative treatment technologies. For the Former Neutralization Pond, the multi-layer cap in conjunction with the slurry wall and drain will provide permanent containment of the waste mass. Treatment will be provided for the collected ground water for both the Former Neutralization Pond and for the terrace drain system. For surface water, removal of contaminated sediments from the IDD and

Retention Ponds is a permanent solution. Where sediments require stabilization, the stabilization is considered an alternative treatment technology. For community soils, the remedial actions will permanently and significantly reduce the volumes of contaminated soils in the community. Stabilization of the Plant site sedimentation pond sediments is considered an alternative treatment technology. Sophisticated point source emission controls will be used to reduce Plant site emissions. Installation of HEPA filters, if the pilot test demonstrates them to be feasible, will be use of an alternative treatment technology.

Preference for Treatment as a Principle Element

Collected ground water will be treated at the Plant Wastewater Treatment Plant. Collected ground water from the Former Neutralization Pond drain will also be treated. IDD and Retention Pond sediments will be removed and treated if necessary for disposal as a solid waste. Stabilization of Plant site sedimentation pond sediments will be used to reduce the mobility of arsenic contamination. Point source emission controls used to reduce Plant site emissions are considered treatment technologies. The Statutory preference for remedies that employ treatment as a principal element is satisfied for the Former Neutralization Pond, Ground Water and Surface Water, and Plant Site Operable Units. Treatment of metal contaminated soils is not technically practicable. Therefore, the selected remedy for the Community Soils Operable Unit focuses on permanent and effective means of reducing mobility and volume of contaminated community soils.

DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Globe site was released for public comment on October 14, 1992. The plan identified Hybrid Alternative 5 (multilayer cap, slurry wall, and ground water drain) for the Former Neutralization Pond Materials Operable Unit. Hybrid Alternative 6 (Terrace Drain/IDD Sediment Removal) and Hybrid Alternative 9 (localized flood aquifer extraction and treatment) for the Ground Water/Surface Water Operable Unit; Hybrid Alternative 5 for the Community Soils and Gardens Operable Unit; Hybrid Alternative 5 (Plant site controls, in-situ stabilization of former sedimentation basin, off-site disposal of Retention Pond sediments), and Hybrid Air Engineering Design Study Option 4 (venturi scrubber in solutions, modified hopper and baghouse in leaching department, potential HEPA installation in premelt and retort, if feasible) for the Plant Site Operable Unit, as the preferred remedy for the site. The hybrid alternatives were the result of combining separate components of FS alternatives to form new alternatives. Except for Air Option 4, the components of the preferred alternatives had been presented in the FS, albeit as components of different alternatives.

CDH has reviewed all written and oral comments submitted during the public comment period. Upon review of the public comments, CDH has determined that no significant changes to the Proposed Plan are warranted. Many additions were incorporated into the Record of Decision as a result of public comment. These include the addition of additional detail in many instances, and the provision of additional remedial components. Additional remedial components to be provided includes construction documentation of the community soils remedy, bilingual educational efforts, clarification of medical monitoring follow-up to be provided, and provision for future gardens.

Public comment to the Proposed Plan yielded many important issues relative to the implementation of the remedy. These issues are discussed in the Responsiveness Summary of this ROD.

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APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

APPENDIX A

ABILITY OF REMEDIAL ALTERNATIVES TO MEET PRINCIPAL ARARs AND TBCs

The following tables compare the ability of each remedial alternative to achieve ARARs and TBCs. One table is presented for each response area. This comparison is discussed in Section 5 of the FS. A discussion of ARARs and TBC's, and a broader list of potential ARARs was compiled and presented in Section 1.6 of the FS, and in Table 1-1.

The notation "will be achieved" means the alternative can be designed to achieve the standard or comply with the ARAR, and that such a design is contemplated by the alternative.

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TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
ARARs					
Chemical Specific					
A. Cadmium					
1. SDWA primary MCL(1) (.01 mg/l)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	Same as alternative 4
2. Colorado Water Quality Control Agricultural Standard, (2) and Clean Water Act Water Quality Criterium for Human Health (3) (.01 mg/l)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
ARARs					
Chemical Specific					
A. Cadmium					
1. SDWA primary MCL(1) (.01/mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved in floodplain ground water in approximately 10 years.	Standard not exceeded in detention pond water. Disturbance of sediments could cause an exceedence.
2. Colorado Water Quality Control Agricultural Standards (2) and Clean Water Act Water Quality Criterium for Human Health (3) (.01 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved in floodplain ground water in approximately 10 years.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
3. S. Platte River Stream standard (4) (.001 mg/l)	South Platte River quality achieves standard under all alternatives.	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
B. Arsenic					
1. SDWA primary MCL (1) (.05 mg/l)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in flood-plain ground water in approximately 100 years.	Same as alternative 4
2. Colorado Water Quality Control Agricultural Standard (2) (.10 mg/l)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will take approximately 30 years to achieve in terrace ground water and approximately 100 years to achieve in flood plain ground water.	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
3. S. Platte River Stream standard (4) (.001 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
B. Arsenic					
1. SDWA primary MCL (1)(.05 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved in floodplain ground water in approximately 10 years.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.
2. Colorado Water Quality Control Agricultural Standard (2) (.10 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved in floodplain ground water in approximately 10 years.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipe line	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
3. S. Platte River Stream Standard (4) (.05 mg/l)	South Platte River quality achieves standard under all alternatives.	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
C. Lead					
1. SDWA primary MCL (1) (.05 mg/l)	Will be achieved, since standard not currently exceeded in ground water or surface water.	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
2. Colorado Water Quality Control Agricultural Standard (2) (.10 mg/l)	Will be achieved, since standard not currently exceeded in ground water or surface water.	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
3. S. Platte River Stream Standard (4) .025 mg/l)	South Platte River quality achieves standard under all alternatives.	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
<u>Location Specific</u>					
None					
TBCs					
1. Proposed SDWA primary MCLG(5) for cadmium (.005 mg/l)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will take longer to achieve proposed MCLG than primary MCL in terrace ground water.	Same as alternative 4
2. SDWA Health Advisories (6) for cadmium (range from .05 to .43 mg/l)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will take less time to achieve SDWA Health Advisory than primary MCL in terrace ground water.	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
8. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (land disposal restrictions for third scheduled wastes)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4
9. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4
10. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4
11. Colorado Water Rights and Irrigation Laws, see §§ 37-82, 83, 90 and 1, C.R.S. (1973 & 1989 Supp.)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	N/A

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
8. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (land disposal restrictions for third scheduled wastes)	N/A	N/A	N/A	Will be achieved for wastes subject to these restrictions	Same as alternative 4
9. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	N/A	N/A	N/A	Will be achieved for materials meeting characteristic of EP toxicity	Same as alternative 4
10. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	N/A	N/A	N/A	Will be achieved for materials meeting characteristics of EP toxicity	Same as alternative 4
11. Colorado Water Rights and Irrigation Laws, see §§ 37-82, 83, 90, and 91, C.R.S. (1973 & 1989 Supp.)	N/A	N/A	N/A	Will be achieved	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

.ndard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
4. Colorado Noise Abatement Statute §§ 25-12-101 to 103, C.R.S. (1989) (Noise limitations for construction activities)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4
5. Colorado Air Quality Control Regulations, 5 CCR 1001-3 (Regulation 1, Section III(D)), 5 CCR 1001-14	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4
6. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4
7. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
4. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989) (noise limitations for construction activities)	N/A	N/A	N/A	Will be achieved	Same as alternative 4
5. Colorado Air Quality Control Regulations, 5 CCR 1001-3 (Regulation 1 Section III(D)), 5 CCR 1001-14	N/A	N/A	N/A	Will be achieved	Same as alternative 4
6. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	N/A	N/A	N/A	Will be achieved	Same as alternative 4
7. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	N/A	N/A	N/A	Will be achieved	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
Action Specific					
1. Colorado Water Quality Control Act and Regulations					
a. Standards and requirements for pretreatment and discharge to POTW, 5 CCR 1002-5	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved. May not be achievable without pretreatment	N/A
b. Standards and requirements for direct discharge to surface water, 5 CCR 1002-8	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved for any point source discharge of pollutants into State waters
2. Clean Water Act dredge and fill requirements, 40 C.F.R. parts 230, 231; 33 C.F.R. part 323.	Will be achieved for any areas determined to be wetlands	Same as alternative 6	Same as alternative 6	Same as alternative 6	Same as alternative 6
3. Underground 'njection Control requirements, 40 C.F.R. parts 144-147	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	N/A

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
Action Specific					
1. Colorado Water Quality Control Act and Regulations					
a. Standards and requirements for pretreatment and discharge to POTW, 5 CCR 1002-5	N/A	N/A	N/A	Will be achieved	Same as alternative 4
b. Standards and requirements for direct discharge to surface water, 5 CCR 1002-8	N/A	N/A	N/A	Will be achieved	Same as alternative 4
2. Clean Water Act dredge and fill requirements, 40 C.F.R. parts 230, 231; 33 C.F.R. part 323.	N/A	N/A	N/A	N/A	N/A
3. Underground Injection Control requirements, 40 C.F.R. parts 144-147	N/A	N/A	N/A	Will be achieved	Same as alternative 4

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
E. Other					
1. Colorado Hazardous Waste Regulations, 6 CCR 1007-3, part 261, Identification of Waste	Same as alternative 4	Same as alternative 4	Same as alternative 4	Same as alternative 4	Any dredged materials meeting characteristics of EP toxicity will be handled and disposed of in accordance with hazardous waste requirements.

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
E. Other					
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of Hazardous Waste	N/A	N/A	N/A	Any excavated materials meeting characteristics of EP toxicity will be handled and disposed of in accordance with hazardous waste requirements.	Same as alternative 4.

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 *Detention Pond* Dredging and Disposal
D. Zinc					
1. SDWA Secondary MCL (1) (5 mg/l) and Clean Water Act Water Quality Criteria for Human Health (3) (5 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Farmers and Gardeners Ditch and floodplain ground water: same as alternative 1.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.
2. Colorado Water Quality Control Agricultural Standard (2) (2 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Farmers and Gardeners Ditch and floodplain ground water: same as alternative 1.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.
3. S. Platte River Stream Standard (4) (.14 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
D. Zinc					
1. SDWA Secondary MCL (1) (5 mg/l) and Clean Water Act Water Quality Criteria for Human Health (3) (5 mg/l)	Farmers and Gardeners Ditch and floodplain ground water: Standard not currently exceeded. Will be achieved. Terrace Ground Water: Will not meet. Industrial Drainage Ditch: will not meet.	Same as alternative 1.	Same as alternative 1.	Farmers and Gardeners Ditch and floodplain ground water: same as alternative 1. Terrace Ground Water: will meet in approximately 30 years. Industrial Drainage Ditch: will meet.	Same as alternative 4
2. Colorado Water Quality Control Agricultural Standard (2) (2 mg/l)	Farmers and Gardeners Ditch and floodplain ground water: standard not currently exceeded. Will be achieved. Industrial Drainage Ditch, Terrace and floodplain ground water: will not meet.	Same as alternative 1.	Same as alternative 1.	Farmers and Gardeners Ditch and floodplain ground water: same as alternative 1. Terrace Ground Water: will meet in approximately 30 years. Industrial Drainage Ditch will meet.	Same as alternative 4.
3. S. Platte River Stream Standard (4) (.14 mg/l)	South Platte River quality achieves standard under all alternatives.	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
3. S. Platte River Stream Standard (4) (.05 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1
C Lead					
1. SDWA primary MCL (1) (.05 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Standard not exceeded in detention pond water.
2. Colorado Water Quality Control Agricultural Standard (2) (.10 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Standard not exceeded in detention pond water.
3. S. Platte River Stream Standard (4) (.025 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs AND TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Prevent Direct Contact	Alternative 4 Terrace Drain/ Continuous Industrial Drainage Ditch Pipeline	Alternative 5 Terrace and Interceptor Drains/ Concrete Industrial Drainage Ditch Pipeline
3. SDWA proposed primary MCLG (5) for arsenic (.05 mg/1)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Will not be achieved in ground water or Industrial Drainage Ditch. Will be achieved in Farmers and Gardeners Ditch.	Will be achieved in Industrial Drainage Ditch and Farmers and Gardeners Ditch. Will be achieved in terrace ground water in approximately 30 years and in floodplain ground water in approximately 100 years.	Same as alternative 4
4. Proposed SDWA primary MCLG (5) for lead (0 mg/1)	Will not be achieved in ground water, Industrial Drainage Ditch or Farmers and Gardeners Ditch	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace and Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
Location Specific					
None					
TBCs					
1. Proposed SDWA primary MCLG(5) for cadmium (.0005 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will take longer to achieve proposed MCLG than primary MCL in floodplain ground water.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.
2. SDWA Health Advisories (6) for cadmium (range from .05 to .43 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will take less time to achieve SDWA Health Advisory than primary MCL in floodplain ground water	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.

TABLE A-1 ABILITY OF ALTERNATIVE TO MEET ARARs and TBCs
Ground Water and Surface Water Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 6 Terrace ahd Interceptor Trench Drains/ Soil Lined Ditch	Alternative 7 Drain(s)/ Slurry Wall	Alternative 8 Drain(s)/ Localized Ground Water Extraction	Alternative 9 Terrace Options Floodplain Extraction and Treatment	Alternative 10 Detention Pond Dredging and Disposal
3. SDWA proposed primary MCLG (5) for arsenic (.05 mg/l)	Same as alternative 4	Same as alternative 4	Same as alternative 4	Will be achieved in floodplain ground water in approximately 10 years.	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.
4. Proposed SDWA primary MCLG (5) for lead (0 mg/l)	Same as alternative 1	Same as alternative 1	Same as alternative 1	Same as alternative 1	Standard not exceeded in detention pond water. Disturbance of sediments could cause exceedence.

FOOTNOTES TO TABLE A-1

1/ Safe Drinking Water Act (SDWA) primary and secondary Maximum Contaminant Levels (MCLs), 40 C.F.R. 141.11 and 143.3. SDWA primary MCLs for cadmium, arsenic and lead are equal to the contaminant levels established under Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 264 § 264.94.

2/ Colorado Water Quality Control Standards-Agricultural Standards, 5 CCR 1002-8.

3/ Clean Water Act (CWA), 33 U.S.C. §§ 1251 to 1376, Water Quality Criteria For Human Health, 51 Fed. Reg. 43,665 (1986).

4/ Colorado Water Quality Control Stream Standards -- Standards for Segment 15 of the South Platte River, 5 CCR 1002-8, § 3.8.6(2).

5/ Safe Drinking Water Act (SDWA) Maximum Contaminant Level Goals (MCLGs) have been proposed but not promulgated by EPA for cadmium, 54 F.R. 22074 (May 22, 1989), arsenic, 50 F.R. 46936 (November 13, 1985), and lead, 53 F.R. 31516 (August 18, 1988).

6/ Safe Drinking Water Act Health Advisories, EPA, Office of Drinking Water Advisory, March 31, 1987.

TABLE A-2 ABILITY OF ALTERNATIVE TO MEET ARARs
Community Soils and Gardens Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Institutional Action	Alternative 3 Soil Remediation "A" Action Levels	Alternative 4 "B" Action Levels	Alternative 5 "C" Action Levels
4. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	N/A	N/A	Will be achieved	Same as alternative 3	Same as alternative 3
5. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	N/A	N/A	Will be achieved	Same as alternative 3	Same as alternative 3
6. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) land disposal restrictions for third scheduled wastes)	N/A	N/A	Will be achieved for wastes subject to these restrictions	Same as alternative 3	Same as alternative 3
7. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989) (noise limitations for construction activities)	N/A	N/A	Will be achieved	Same as alternative 3	Same as alternative 3

TABLE A-2 ABILITY OF ALTERNATIVE TO MEET ARARs
Community Soils and Gardens Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Institutional Action	Alternative 3 Soil Remediation "A" Action Levels	Alternative 4 "B" Action Levels	Alternative 5 "C" Action Levels
Chemical Specific					
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of Hazardous Waste	N/A	N/A	Excavated materials meeting characteristics of EP toxicity will be handled and disposed of in accordance with hazardous waste requirements	Same as alternative 3	Same as alternative 3
Action Specific					
1. Colorado Air Quality Control Regulations, 5 CCR 1001-3 (Regulation 1, Section III(D)), 5 CCR 1001-14	N/A	N/A	Will be achieved	Same as alternative 3	Same as alternative 3
2. Colorado Solids and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	N/A	N/A	Will be achieved	Same as alternative 3	Same as alternative 3
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	N/A	N/A	Will be achieved for materials meeting characteristics of EP toxicity	Same as alternative 3	Same as alternative 3

TABLE A-2 ABILITY OF ALTERNATIVE TO MEET ARARs
Community Soils and Gardens Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Institutional Action	Alternative 3 Soil Remediation "A" Action Levels	Alternative 4 "B" Action Levels	Alternative 5 "C" Action Levels
<u>Location Specific</u>					
None					

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Plant-Site Controls/ In-Situ Sediment Stabilization
Chemical Specific			
1. Colorado Air Quality Control Regulations, 5 CCR 1001-10 (ambient air standard for lead, 1.5 ug/m3 monthly average)	The plant's contribution to exceedence of this standard on one occasion is not known. Ability to achieve ARARs at increased capacity may need to be determined	Same as alternative 1	Will be achieved
2. Colorado Air Quality Control Regulations, 5 CCR 1001-14 (ambient air standard for Total Suspended Particulates; primary standard: 75 ug/m 3 annual geometric mean, 260 ug/m3 24 hour standard; secondary standard: 60 ug/m3 annual geometric mean, 150 ug/m3 24 hour standard	The entire Denver metropolitan area regularly exceeds these standards, and is considered to be a "non-attainment area" for these parameters.	Same as alternative 1	Same as alternative 1

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Response Area

Standard, Requirement, Criteria, or Limitation	Alternative 4 Plant Site Controls/ Sediment Excavation and On-Site Disposal	Alternative 5 Plant Site Controls/ Sediment Stabilization and On-site Disposal	Alternative 6 Plant Site Controls/ Off-Site Disposal of Sediments
<u>Chemical Specific</u>			
1. Colorado Air Quality Control Regulations, 5 CCR 1001-10 (ambient air standard for lead, 1.5 ug/m3 monthly average)	Same as alternative 3	Same as alternative 3	Same as alternative 3
2. Colorado Air Quality Control Regulations, 5 CCR 1001-14 (ambient air standard for Total Suspended Particulates; primary standard: 75 ug/m 3 annual geometric mean, 260 ug/m3 24 hour standard; secondary standard: 60 ug/m3 annual geometric mean, 150 ug/m3 24 hour standard	Same as alternative 1	Same as alternative 1	Same as alternative 1

TABLE A-3 ABILITY OF *ALTERNATIVE TO MEET ARARs*
Plant Soils, Sediments, and Facilities Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Plant-Site Controls/ In-Situ Sediment Stabilization
3. National Primary and Secondary Ambient Air Quality Standards 40 C.F.R. part 50.6, for particulate matter less than 10 microns; primary and secondary standard: 50 ug/m3 annual arithmetic mean, 150 ug/m3 24 hour standard (PM10)	The entire Denver metropolitan area has been determined to exceed the standard with a probability of greater than or equal to 95 percent. The area is designated as Group I area.	Same as alternative 1	Same as alternative 1
4. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261. Identification of Hazardous Waste	N/A	N/A	Excavated materials meeting the characteristic of EP toxicity will be handled in accordance with hazardous waste requirements

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Plant-Site Controls/ In-Situ Sediment Stabilization
<u>Action Specific</u>			
1. Colorado Air Quality Control Regulations, 5 CCR 1001-3, Regulation 1, Section III(D), 5 CCR 1001-14	N/A	N/A	Will be achieved
2. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	Will not comply if sediments meet characteristic of EP Toxicity	Will not comply if sediments meet characteristic of EP Toxicity	Will be achieved
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	Will not comply if sediments meet characteristics of EP Toxicity	Will not comply if sediments meet characteristic of EP Toxicity	Will be achieved if sediments meet the characteristic of EP toxicity
4. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	N/A	N/A	N/A

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARS
Plant Soils, Sediments, and Facilities Response Area

Standard, Requirement, Criteria, or Limitation	Alternative 4 Plant Site Controls/ Sediment Excavation and On-site Disposal	Alternative 5 Plant Site Controls/ Sediment Stabilization and On-site Disposal	Alternative 6 Plant Site Controls/ Off-Site Disposal of Sediments
3. National Primary and Secondary Ambient Air Quality Standards 40 C.F.R. part 50.6, for particulate matter less than 10 microns; primary and secondary standard: 50 ug/m3 annual arithmetic mean, 150 ug/m3 24 hour standard (PM10)	Same as alternative 1	Same as alternative 1	Same as alternative 1
4. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261. Identification of Hazardous Waste	Same as alternative 3	Same as alternative 3	Same as alternative 3

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Plant-Site Controls/ In-Situ Sediment Stabilization
5. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	N/A	N/A	N/A
6. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) land disposal restrictions for third scheduled wastes)	N/A	N/A	N/A
7. Federal Clean Water Act Nonpoint Source Control Requirements, 33 U.S.C. § 1314(e); 40 C.F.R. 125(K)	May not achieve	Same as alternative 1	Will be achieved
8. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989) (noise limitations for construction activities)	N/A	N/A	Will be achieved

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Response Area

Standard, Requirement, Criteria, or Limitation	Alternative 4 Plant Site Controls/ Sediment Excavation and On-site Disposal	Alternative 5 Plant Site Controls/ Sediment Stabilization and On-site Disposal	Alternative 6 Plant Site Controls/ Off-Site Disposal of Sediments
Action Specific			
1. Colorado Air Quality Control Regulations, 5 CCR 1001-3, Regulation 1, Section III(D), 5 CCR 1001-14	Same as alternative 3	Same as alternative 3	Same as alternative 3
2. Colorado Solid and Hazardous Wastes Disposal Sites and Facilities Regulations, 6 CCR 1007-2	Same as alternative 3	Same as alternative 3	N/A*
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3	Same as alternative 3	Same as alternative 3	Same as alternative 3
4. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	N/A	N/A	Will be achieved

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Operable Unit

Standard, Requirement, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Plant-Site Controls/ In-Situ Sediment Stabilization
<u>Location Specific</u>			
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, § 264.18 (disposal facility *may not* be located close to a fault or in 100-year floodplain)	N/A	N/A	N/A

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARS
Plant Soils, Sediments, and Facilities Response Area

Standard, Requirement, Criteria, or Limitation	Alternative 4 Plant Site Controls/ Sediment Excavation and On-site Disposal	Alternative 5 Plant Site Controls/ Sediment Stabilization and On-site Disposal	Alternative 6 Plant Site Controls/ Off-Site Disposal of Sediments
5. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	N/A	N/A	Will be achieved
6. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (proposed land disposal restrictions for third scheduled wastes)	Will be achieved for wastes subject to these restrictions	Same as alternative 4	Same as alternative 4
7. Federal Clean Water Act Nonpoint Source Control Requirements, 33 U.S.C. § 1314(e); 40 C.F.R. 125(K)	Same as alternative 3	Same as alternative 3	Same as alternative 3
8. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989) (noise limitations for construction activities)	Same as alternative 3	Same as alternative 3	Same as alternative 3

TABLE A-3 ABILITY OF ALTERNATIVE TO MEET ARARs
Plant Soils, Sediments, and Facilities Response Area

Standard, Requirement, Criteria, or Limitation	Alternative 4 Plant Site Controls/ Sediment Excavation and On-site Disposal	Alternative 5 Plant Site Controls/ Sediment Stabilization and On-site Disposal	Alternative 6 Plant Site Controls/ Off-Site Disposal of Sediments
Location Specific			
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, § 264.18 (disposal facility may not be located close to a fault or in 100-year floodplain)	Will be achieved	N/A	N/A[A]

FOOTNOTES TO TABLE A-3

[a]Hazardous waste disposal regulations are not ARARs where disposal is offsite. However, CERCLA requires that in the case of any response action involving the transfer of a hazardous substance offsite, the hazardous substance may only be transferred to a facility that complies with §§ 3004 and 3005 of the Solid Waste Disposal Act and complies with all other applicable federal law and all applicable State requirements.

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
Note: Materials in the neutralization pond meet the characteristic of EP toxicity as set forth in the Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of hazardous waste.				
Chemical Specific				
None				
Action Specific				
. Colorado Solid and Hazardous Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, solid waste provisions				

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
Note: Materials in the neutralization pond meet the characteristic of EP toxicity as set forth in the Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 261, Identification of hazardous waste				
Chemical Specific				
None				
Action Specific				
1. Colorado Solid and Hazardous Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, solid waste provisions				

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
a. § 2.1-2.4 (minimum design and operation standards requiring compliance with all health, air and water laws, prevention of odors and other nuisances, surface water diversion, ground water monitoring, prohibition against receiving hazardous waste unless authorized, inspection and closure requirements)	N/A	N/A	N/A	N/A
b. § 4 (site and design standards and data requirements for new facilities)	N/A	N/A	N/A	N/A
2. Colorado Solid and Hazardous Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, part 2, Hazardous Waste provisions				

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
a. § 2.1-2.4 (minimum design and operation standards requiring compliance with all health, air and water laws, prevention of odors and other nuisances, surface water diversion, ground water monitoring, prohibition against receiving hazardous waste unless authorized, inspection and closure requirements)	N/A	N/A	Will be achieved	N/A*
b. § 4 (site and design standards and data requirements for new facilities)	N/A	N/A	Will be achieved	N/A*
2. Colorado Solid and Hazardous Waste Disposal Sites and Facilities Regulations, 6 CCR 1007-2, part 2, Hazardous Waste Provisions				

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
a. §§ 2.4.1-2.4.5 (design facility to prevent long-term adverse effects on ground water, surface water, air quality, public health, and the environment)	Will not achieve	Same as alternative 1	Ability to achieve unlikely so long as materials are potentially in contact with ground water	Same as alternative 3
b. § 2.4.6 (maintain liner integrity and performance)	N/A	N/A	N/A	N/A
c. § 2.4.7 (design runoff and leachate control system sufficient to prevent adverse effects on ground water, surface water, air quality, public health, and the environment)	Will not achieve	Same as alternative 1	Will be achieved	Same as alternative 3
d. § 2.4.8 (close facility to assure long-term compliance with §§ 2.4.1-2.4.5 and 2.4.7)	Will not achieve	Same as alternative 1	Ability to achieve unlikely so long as materials are potentially in contact with ground water	Same as alternative 3
e. §§ 2.4.9 and 2.4.10 (monitor ground and surface water; provide quality control during construction)	Will not achieve	Same as alternative 1	Will be achieved	Same as alternative 3

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
a. §§ 2.4.1-2.4.5 (design facility to prevent long-term adverse effects on ground water, surface water, air quality, public health, and the environment)	Will be achieved	Same as alternative 5	N/A	N/A*
b. § 2.4.6 (maintain liner integrity and performance)	N/A	Will be achieved	N/A	N/A*
c. § 2.4.7 (design runoff and leachate control system sufficient to prevent adverse effects on ground water, surface water, air quality, public health, and the environment)	Sames as alternative 3	Same as alternative 3	N/A	N/A*
d. § 2.4.8 (close facility to assure long-term compliance with §§ 2.4.1-2.4.5 and 2.4.7)	Will be achieved	Same as alternative 5	N/A	N/A*
e. §§ 2.4.9 and 2.4.10 (monitor ground and surface water; provide quality control during construction)	Same as alterntive 3	Same as alternative 3	N/A	N/A*

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
f. §§ 2.5.1, 2.5.2 and 2.5.6 (design to assure compliance with criteria of § 2.4; design to assure odor control, fire protection, site security, protective operation)	Will not achieve	Same as alternative 1	Ability to achieve unlikely so long as materials are potentially in contact with ground water	Same as alternative 3
g. § 2.5.3 (geological and hydrological conditions of a site in which hazardous wastes are to be disposed shall be such that reasonable assurance is provided that such wastes are isolated within the designated disposal area of the site and away from natural environmental pathways that could expose the public for 1,000 years, or some demonstrated shorter period in which the wastes are transformed to an innocuous condition)	Will not achieve	Same as alternative 1	Ability to achieve unlikely so long as materials are potentially in contact with ground water	Same as alternative 3
h. §§ 2.5.4 and 2.5.5 (design requirements for liner and leachate and runoff control system)	Will not achieve	Same as alternative 1	Ability to achieve unlikely so long as materials are potentially in contact with ground water	Same as alternative 3

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
f. §§ 2.5.1, 2.5.2 and 2.5.6 (design to assure compliance with criteria of § 2.4; design to assure odor control, fire protection, site security, protective operation)	Will be achieved	Same as alternative 5	N/A	N/A*
g. § 2.5.3 (geological and hydrological conditions of a site in which hazardous wastes are to be disposed shall be such that reasonable assurance is provided that such wastes are isolated within the designated disposal area of the site and away from natural environmental pathways that could expose the public for 1,000 years, or some demonstrated shorter period in which the wastes are transformed to an innocuous condition)	Ability to achieve uncertain	Same as alternative 5	N/A	N/A*
h. §§ 2.5.4 and 2.5.5 (design requirements for liner and leachate and runoff control system)	Will be achieved	Same as alternative 5	N/A	N/A*

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 262 (standards applicable to generators of hazardous waste)	N/A	N/A	N/A	N/A
4. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 263 (standards applicable to transporters of hazardous waste)	N/A	N/A	N/A	N/A
5. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 264 (standards for owners and operators of hazardous waste treatment, storage, and disposal facilities)				

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TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
3. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 262 (standards applicable to generators of hazardous waste)	N/A	N/A	Will be achieved, materials will be tested to assure they do not meet the characteristic of EP toxicity	Will be achieved
4. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 263 (standards applicable to transporters of hazardous waste)	N/A	N/A	N/A	N/A*
5. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 264 (standards for owners and operators of hazardous waste treatment, storage, and disposal facilities)				

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
a. Subparts B-E (facility standards, preparedness, emergency planning, record keeping and reporting)	N/A	N/A	N/A	N/A
b. Subpart F (ground water protection standards including monitoring requirements)	N/A	N/A	N/A	N/A
c. Subpart G (closure and post-closure) including § 264.111 (closure to minimize maintenance and control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere)	N/A	N/A	N/A	N/A

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
a. Subparts B-E (facility standards, preparedness, emergency planning, record keeping and reporting)	N/A	Will be achieved	N/A	N/A*
b. Subpart F (ground water protection standards including monitoring requirements)	N/A	Will be achieved	N/A	N/A*
c. Subpart G (closure and post-closure) including § 264.111 (closure to minimize maintenance and controls, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere)	N/A	Will be achieved	N/A	N/A*

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
d. Subpart N (requirements for landfills) including § 264.301(c) (double liner and leachate collection system required) and § 264.310 (final cover designed and constructed to minimize migration of liquids through landfill, require minimum maintenance, have permeability less than or equal to permeability of bottom liner system or natural soils, collect leachate until no longer detected, and prevent erosion from run-on and run-off)	N/A	N/A	N/A	N/A
6. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 265 (standards for owners and operators of interim status hazardous waste treatment, storage, and disposal facilities)				

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
d. Subpart N (requirements for landfills) including § 264.301(c) (double liner and leachate collection system required) and § 264.310 (final cover designed and constructed to minimize migration of liquids through landfill, require minimum maintenance, have permeability less than or equal to permeability of bottom liner system or natural soils, collect leachate until no longer detected, and prevent erosion from run-on and run-off)	N/A	Will be achieved	N/A	N/A*
6. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, part 265 (standards for owners and operators of <u>interim status</u> hazardous waste treatment, storage, and disposal facilities)				

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
a. Subparts B-E (facility standards, preparedness, emergency planning, record keeping and reporting)	Will not achieve	Same as alternative 1	Will be achieved	Same as alternative 3
b. Subpart F (ground water protection standards including monitoring requirements)	Will not achieve	Will be achieved	Same as alternative 2	Same as alternative 2
c. Subpart G (closure and post-closure) including § 265.111 (closure to minimize maintenance and control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere)	Will not achieve	Same as alternative 1	Ability to achieve uncertain	Same as alternative 3

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
a. Subparts B-E (facility standards, preparedness, emergency planning, record keeping and reporting)	Same as alternative 3	N/A	N/A	N/A*
b. Subpart F (ground water protection standards including monitoring requirements)	Same as alternative 2	N/A	N/A	N/A*
c. Subpart G (closure and post-closure) including § 265.111 (closure to minimize maintenance and control, minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere)	Same as alternative 3	N/A	N/A	N/A*

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
d. Subpart N (requirements for closing landfills) including § 265.310 (final cover designed and constructed to minimize migration of liquids through landfill, require minimum maintenance, have permeability less than or equal to permeability of bottom liner system or natural soils, collect leachate until no longer detected, and prevent erosion from run-on and run-off)	Will not achieve	Same as alternative 1	Ability to achieve uncertain	Will be achieved
7. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	N/A	N/A	N/A	N/A
8. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	N/A	N/A	N/A	N/A
9. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (proposed land disposal restrictions for third scheduled wastes)	N/A	N/A	N/A	N/A

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off Site Disposal
d. Subpart N (requirements for closing landfills) including § 265.310 (final cover designed and constructed to minimize migration of liquids through landfill, require minimum maintenance, have permeability less than or equal to permeability of bottom liner system or natural soils, and prevent erosion from run-on and run-off)	Same as alternative 4	N/A	N/A	N/A*
7. Colorado Rules and Regulations Concerning Transportation of Hazardous Materials, 8 CCR 1507	N/A	N/A	N/A	Will be achieved
8. Federal Hazardous Materials Transportation Regulations, 49 C.F.R. parts 107, 171-177	N/A	N/A	N/A	Will be achieved
9. Land Disposal Criteria, 40 C.F.R. part 268; 55 F.R. 22520 (June 1, 1990) (proposed land disposal restrictions for third scheduled wastes)	N/A	Will be achieved for wastes subject to these restrictions	Will be achieved for wastes subject to these restrictions	Will be achieved

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 1 No Action	Alternative 2 Periodic Monitoring	Alternative 3 Clay Cap	Alternative 4 Multi-Layer Cap
10. Colorado Air Quality Control Regulations, 5 CCR 1001, (Regulation 1, Section III(D)), 1001-14	N/A	Will be achieved	Same as alternative 2	Same as alternative 2
11. Colorado Noise Abatement Statute, SS 25-12-101 to 103, C.R.S. (1989)	N/A	Will be achieved	Same as alternative 2	Same as alternative 2
<u>Location Specific</u>				
1. Colórado Hazardous Waste Management Regulations, 6 CCR 1007-3, § 264.18 (disposal facility may not be located close to a fault or in 100-year floodplain)	N/A	N/A	N/A	N/A

TABLE A-4 ABILITY OF ALTERNATIVE TO MEET ARARs
Former Neutralization Pond Operable Unit

Standard, Requirements, Criteria, or Limitation	Alternative 5 Multi-Layer Cap with Slurry Wall and Reversed Groundwater Gradients	Alternative 6 Excavation of Materials/ On-Site Subtitle C Disposal	Alternative 7 Excavation of Materials/ On-Site Stabilization and Subtitle D Disposal	Alternative 8 Excavation of Materials/ Stabilization and Off-Site Disposal
10. Colorado Air Quality Control Regulations, 5 CCR 1001-3 (Regulation 1, Section III(D)), 1001-14	Same as alternative 2	Same as alternative 2	Same as alternative 2	Same as alternative 2
11. Colorado Noise Abatement Statute, §§ 25-12-101 to 103, C.R.S. (1989)	Same as alternative 2	Same as alternative 2	Same as alternative 2	Same as alternative 2
Location Specific	Same as alternative 2			
1. Colorado Hazardous Waste Management Regulations, 6 CCR 1007-3, § 264.18 (disposal facility may not be located close to a fault or in 100-year floodplain)	N/A	Will be achieved	N/A	N/A*

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FOOTNOTES TO TABLE A-4

1/ *Hazardous Waste disposal regulations are not ARARs where disposal is offsite. However, CERCLA requires that in the case of any response action involving the transfer of a hazardous substance offsite, the hazardous substance may only be transferred to a facility that complies with §§ 3004 and 3005 of the Solid Waste Disposal Act and complies with all other applicable federal law and all applicable State requirements.

APPENDIX B

Table 1. Exposure intake parameters used to calculate residual risks.

Exposure parameter	Default value
Soil ingestion rate (IR_s), mg/day	
Children < 6 yrs	200
Children > 6 yrs and adults	100
Time-weighted average, 30 years exposure	120
Body weight (BW), kg	
6 yrs	15
24 yrs	70
Time-weighted average, 30 years exposure	59
Exposure frequency (EF), days/yr	350 days
Exposure Duration (ED), years	30 years
Averaging time (AT), days	
Carcinogenic risk = 70 years x 365 d/yr	25550 days
Noncarcinogenic effects = 30 years x 365 d	10950 days
Unit conversion factor (CF)	Variable
Inhalation rate, air (IR_a), cubic meters per day	20 m^3/day
Absorption (Abs), percent	Variable
Arsenic	
soil ingestion	80 %
inhalation, ambient air/fugitive dust	30 %
Cadmium	
soil ingestion	NA[1]
inhalation - ambient air/fugitive dust	100%[2]

1. Bioavailability is accounted for in the RfD.
2. Assumes 100% of deposited dose is inhaled.

Table 2. Toxicity values used to calculate residual risks, mg/kg/d

Chemical	Oral RfD	Oral SF	Inhalation RfC	Inhalation Slope factor
Arsenic	0.0003	1.75	ND[1]	50
Cadmium				
water	0.0005	NA[2]		
food/soil	0.001		NA[2]	
air	NA[2]	NA[2]	ND[1]	6.1

1. ND = No data available/data inadequate for quantitative assessment.
2. NA = Not applicable for this route/pathway.

Table 3. Risk of additional cancers due to arsenic exposure.

Pathway	Current conditions (Avg.)	Current conditions (Max.)	Conditions after remediation (As=28)	Conditions after remediation (As=70)
Soil ingestion	2.2×10^{-5}	9.2×10^{-3}	3.3×10^{-5}	8.2×10^{-5}
Direct inhalation ambient air	1.5×10^{-4}	1.7×10^{-3}	NC[2]	NC[2]
Fugitive dust	NA[1]	NA[1]	2.7×10^{-6}	6.8×10^{-6}
Garden produce ingestion	5.1×10^{-5}	2.1×10^{-4}	7×10^{-6}	2×10^{-5}
TOTAL	2×10^{-4}	1×10^{-2}	4×10^{-5}	1×10^{-4}

1. NA = Not assessed in the PHE. The PHE used actual air pollutant measurements from the Globe area neighborhood. These metals levels represent the combined impacts of metals emissions from stacks, and from fugitive dust.
2. Will be evaluated after results of pilot test are complete.
3. Risk estimates for conditions after remediation have been calculated using current risk assessment guidance (RAGS). Risk estimates for current conditions were calculated using risk assessment guidance available at the time of the PHE (SPHEM).

Table 4. Risk of additional cancers due to cadmium exposure.

Pathway	Current conditions (Avg.)	Current conditions (Max.)	Conditions after remediation (Cd = 73)
Direct inhalation ambient air	$2x10^{-4}$	$2x10^{-3}$	NC[2]
Fugitive dust	NA[1]	NA[1]	1.9×10^{-6}
TOTAL	2×10^{-4}	2×10^{-3}	1.9×10^{-6}

1. NA = Not assessed in the PHE. The PHE used actual air pollutant measurements from the Globe area neighborhood. These metals levels represent the combined impacts of metals emissions from stacks, and from fugitive dust.
2. NC = Not calculated. Will be evaluated after results of pilot test are complete.
3. Risk estimates for conditions after remediation have been calculated using current risk assessment guidance (RAGS). Risk estimates for current conditions were calculated using risk assessment guidance available at the time of the PHE (SPHEM).

Table 5. Noncarcinogenic effects due to arsenic exposure.

Pathway	Hazard quotient Current conditions (Avg.) (Max.)	Hazard quotient, Conditions after remediation (As=28)	(As=70)
Soil ingestion	NA[1]	.15	.36
Garden produce ingestion	NA[1]	.03	.08
TOTAL		.18	.44

1. NA = Not assessed in the PHE. No published toxicity value for noncarcinogenic effects associated with chronic oral exposure to arsenic.

Table 6. Noncarcinogenic effects due to cadmium exposure.

Pathway	Hazard Quotient Current conditions (Avg.)	(Max.)	Hazard Quotient, Conditions after remediation (Cd = 73)
Soil ingestion	0.19	217	.14
Garden produce ingestion	0.11	1.5	.41
TOTAL	0.3	219	.55

Risk estimates for conditions after remediation have been calculated using current risk assessment guidance (RAGS).

Table 7. Summary of residual risk under the proposed plan.

Pathway	Total excess CA risk As=28	As =70	Hazard indices As=28	As=70	Cd=73
Soil ingestion	3×10^{-5}	8×10^{-5}	.15	.36	.14
Garden produce ingestion	7×10^{-6}	2×10^{-5}	.03	.08	.41
Inhalation of fugitive dust (Cd + As)	5×10^{-6}	9×10^{-6}	NA	NA	NA
TOTAL	5×10^{-5}	1×10^{-4}	.44	.55	.69

1. Cancer risks for cadmium and arsenic are assumed to be additive.
2. Systemic (non-carcinogenic) risks are not added for arsenic and cadmium because they do not affect the same target organ.

INTRODUCTORY REMARKS

Several commentors stated that a great deal of specific detail should be included in the Proposed Plan, while others found the document difficult to read and too long.

The Proposed Plan is primarily a public participation document and is expected to be widely read. As such, it is to be written in a clear and concise manner using non-technical language. The Proposed Plan "highlights key aspects of the RI/FS, provides a brief analysis of remedial alternatives under consideration, identifies the preferred alternative, and provides members of the public with information on how they can participate in the remedy selection process." (A Guide to Developing Superfund Proposed Plans, U.S. EPA, May 1990) The Proposed Plan for cleanup of the Asarco Globe site meets these objectives. Summaries of the results of the RI, the risks posed by the contamination, and the FS remedial alternatives were presented. An evaluation of these remedial alternatives, using the CERCLA nine criteria, was presented in tabular fashion. The preferred alternative was described in more detail. The site Proposed Plan directs readers to the RI/FS documents and the administrative record for additional information, as recommended in the EPA guidance.

The NCP, at 300.430(f)(5), describes the requirements of proposed plans. "The lead agency...shall prepare a proposed plan that briefly describes the remedial alternatives analyzed by the lead agency, proposes a preferred remedial action alternative, and summarizes the information relied upon to select the preferred alternative....The purpose of the proposed plan is to supplement the RI/FS and provide the public with a reasonable opportunity to comment on the preferred alternative for remedial action, as well as alternative plans under consideration, and to participate in the selection of remedial action at a site." All NCP requirements for proposed plans have been met.

When preparing the Proposed Plan, we attempted to make the document as brief as possible, while including a great deal of factual information. For those who prefer a shorter, more simple document, the Proposed Plan began with a two-page citizen's summary. Many of the specific details requested by the commentors can be found in the RI/FS documents and administrative record. The guidance recommends that the Proposed Plan be issued in a Fact Sheet format. We recognize that certain commentors are reading the document with specific interests in mind. However, any proposed plan for wide distribution can not be expected to respond to each concern of each reader without compromising conciseness or readability.

Some commentors questioned whether the ground water portion of the remedy is consistent with the NCP.

The ground water remedy for the site is protective of human health and the environment and is consistent with the NCP. The remedy includes a variety of methods to contain the contaminated plume and meet remediation goals. The Former Neutralization Pond, a source of ground water contamination, will be isolated from ground water with treatment provided to collected ground water from the pond. The terrace drain system will intercept and collect contaminated ground water, preventing future contamination from entering the floodplain system. If necessary, ground water will be extracted from a localized area near well GW-64. Long-term monitoring will be provided to ensure that contaminated ground water does not flow from the terrace into the floodplain and to monitor the decline of contaminants in the terrace and floodplain systems. All collected ground water will be treated to meet ARARs prior to discharge. The contaminated ground water still remaining in the plume will be remediated through natural attenuation.

The NCP has acknowledged "the practical limitations on the use of treatment" (55 Fed. Reg. at 8700) and allows use of natural attenuation of ground water which is "unlikely to be used in the foreseeable future and therefore can be remediated over an extended period of time...or where natural attenuation is expected to reduce the concentration in the groundwater to the remediation goals...in a reasonable time frame" (55 Fed. Reg. at 8734).

A remediation time frame of 30 years is expected for terrace ground water and one of 100 years or less is expected for floodplain ground water. The NCP states that remediation timeframes are to be based on particular site circumstances (55 Fed. Reg. at 8734). When referring to situations where "natural attenuation, wellhead treatment with monitoring, and institutional controls may be the only feasible remedies" for sites where "levels of contaminants are projected to attenuate," EPA defines a reasonable time period in which cleanup levels should be achieved as "less than 100 years" (EPA, Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites, OSWER Directive 9283.1-2, 1988). When determining a reasonable time period, EPA considers the expected use of the water. "If there are other readily available drinking water sources of sufficient quality and yield that may be used as an alternative water supply, the necessity for rapid restoration of the contaminated groundwater may be reduced." (55 Fed. Reg. at 8732). All water users within the floodplain are connected either to the City and County of Denver or the Adams County water supply systems, therefore there are readily available drinking water sources for use as an alternate water supply.

The NCP's expectation concerning ground water remediation where complete restoration is not practicable focuses on "prevent(ion of) contaminant migration and further contamination of the ground water, prevention of exposures, and evaluation of further risk reduction" (55 Fed. Reg. at 8734). The site ground water remedy prevents the spread of contamination, controls the source of contamination, and provides long-term monitoring. The contaminant plume is well-defined, does not endanger other aquifers in the Denver metro area, and will almost certainly not be used as a water supply in the future. The well installation prohibition is a further assurance that the ground water will not be put to beneficial use. Installation of water wells within the contaminated portions of the floodplain aquifer is prohibited by Rule 10.2.2 of the rules of the State of Colorado's Office of State Engineer State Board of Examiners of Water Well Construction and Pump Installation Contractors (revised effective July 30, 1988).

Commentors wanted a more detailed discussion of residual risk, i.e., risk that will remain after the remedy is implemented.

A discussion of residual risk is presented for each operable unit of the selected remedy. These discussions include the mechanisms through which risk reduction is achieved, the magnitude of residual risk once remedial actions are complete, and the magnitude of risk that would be expected if no remedial actions were to occur. For ease of reference, we have developed tables that present risk estimates for each exposure scenario where residual risk can be calculated. The tables are presented in Appendix B.

Potential health risks from the soil pathway include exposure via direct ingestion of contaminated soil or garden produce, and inhalation of fugitive dust emissions from disturbed or wind-blown soils. Residual risk has been calculated for the proposed soil cleanup levels and is summarized in Tables 3 through 7 in Appendix B. Risks were calculated using exposure parameters recommended by EPA in its March 25, 1991 Supplemental Guidance on Selection of Standard Default Exposure Factors (OSWER Directive 9285.6-03), and oral and inhalation toxicity values published in the IRIS database as of December 31, 1992 (see Tables 1 and 2, Appendix B). Chemical intake was calculated using the equations on pages 6-40, 6-44 and 6-46 of the Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A (EPA/540/1-89/002).

Currently there are no published toxicity values available to calculate health risks associated with exposure to lead. EPA has developed a multi-media model called the Uptake Biokinetic Model (UBK) to assess the potential for adverse effects on children as a result of lead exposure in various media (water, soil, dust, air and gardens) based on resulting blood lead levels predicted by the model for site-specific conditions. However, this model is still undergoing peer review and has not yet been officially recommended by EPA for use in risk assessment. A soil cleanup level of 500 ppm was selected for this site based on EPA's 1989 Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund sites (OSWER Directive #9355.4-02). This guidance recommends cleanup levels of 500 to 1000 ppm for residential settings, based on a review of studies which correlate soil lead concentrations with children's blood lead levels. If official guidance is issued by the EPA regarding appropriate use of the UBK model to assess risk to young children, potential risk from lead exposure will be reassessed for this site under the new guidance to be sure that the remedy is protective.

For the Globe site community soils remedy, the required action level for arsenic, 70 mg/kg, represents a protective cleanup level that falls within the acceptable risk range. Cleanup will be required to this level to ensure that all properties within the site area are cleaned to an acceptable risk level. However, the state recognizes that many residents may desire cleanup to a more protective level. The state has established that the anthropogenic upper limit of background for arsenic is 28 mg/kg. The state has included in the selected remedy an opportunity for residential properties that have contaminant levels above this background level to have their properties cleaned up. This cleanup of properties above this voluntary action level provides the maximum practicable level of protection to the community. The residual risk associated with this level of soil cleanup, for all potential soil pathways including soil ingestion, inhalation of fugitive dust, and vegetable ingestion, is $3x10^{-5}$ excess cancer risk.

For the air remedy, the selected remedy represents the best technical alternatives available to the state, while ensuring that the residual risk from the air remedy remains within protective levels. The air remedy already provides for a residual risk that is within the risk range (10^{-4} to 10^{-6}) and will be health protective for non-carcinogens (systemic toxicants). When the HEPA pilot test is completed, a risk assessment will be conducted using EPA risk assessment methods and EPA reference concentrations as well as source apportionment. The cumulative site risk must fall below the $1x10^{-4}$ risk range endpoint and the cumulative site hazard index must be less than or equal to one. If the HEPA pilot test shows that HEPAs are feasible, the remedy will provide additional risk reductions. The Air Engineering Design Study estimated that reductions to the $1x10^{-5}$ excess cancer risk level could be achieved if the HEPA filter technology is feasible. Since final risk estimates will not be available for the air portion of the site remedy until the HEPA pilot test is complete, it is not possible to aggregate risk due to exposure to Plant site emissions.

For the surface water remedy, sediments in the IDD and Retention Ponds will be removed and landfilled. Since the sediments will be removed from any potential exposures, residual risks due to sediment exposure has been eliminated. For the

Detention Pond sediments, there is currently no completed exposure route, so there is no current risk. Should the sediments become exposed and therefore complete an exposure pathway, the sediments will be removed or covered. The removal or covering will eliminate the exposure pathway, so any risk from these sediments will be eliminated. For the ground water remedy, two water well use surveys, completed in 1987 and in 1992, found no current users of the contaminated plume, so current excess cancer risk is zero. Annual water well use surveys will be conducted as a part of the remedy to ensure that there is no domestic water use from the contaminated plume. Potential future use is prohibited by current State Engineer regulations. All water users within the floodplain are connected either to the City and County of Denver or the Adams County water supply systems.

Commentors were concerned regarding the potential for residual risks due to inhalation of wind-blown soil (fugitive dust).

There is currently no method that is recommended and routinely used to assess risks associated with fugitive dust emissions from wind erosion of exposed soil particles. One reason for this gap in available risk assessment methodology is that fugitive dust exposure is often considered to be a relatively minor source of potential risk at Superfund sites when compared to risks from direct ingestion of soil and therefore is not assessed quantitatively. Where actual measurements of ambient air are available, total concentrations measured in ambient air will be representative of the total contaminant concentration from both point source emissions (i.e., stack emissions) as well as fugitive dust emissions, such as was the case with the risks calculated in the Public Health Evaluation (PHE). Risk from inhalation of fugitive dust was not calculated separately from risk associated with stack emissions.

To accurately calculate risk associated with inhalation of fugitive dust, several site specific parameters are necessary for each contaminant of interest, including: the particulate concentration in the air; the particle size distribution (i.e., fraction that is respirable); the concentration of the chemical in the respirable fraction; the erodibility of the soil; and the amount of vegetative cover present. Most of these site-specific data are not available for the Globe site.

There has been a persistent community concern about cancer risks associated with inhalation of fugitive dust emissions which could be expected from cadmium in soil with cadmium levels of 73 ppm. Although the site-specific data enumerated above are not available, several conservative assumptions have been made in order to make a reasonable attempt to calculate what this potential residual risk would be. The assumptions made were as follows:

1. The soil concentration equals the soil action level for each chemical.
2. The concentration in dust equals the concentration in the surface soil.
3. Dust loading, as measured by total suspended particulate (TSP) concentration, equals 125 ug/m^3, based on the maximum annual average concentration from all sampling locations (maximum concentration was at the Garden Place Elementary sampling station).
4. 50% of the total airborne TSP concentration originates from fugitive dust emissions from wind-blown soil that contains 73 ppm cadmium.
5. 50% of the total airborne particulates are bioavailable, based on the assumption that 50% of all inhaled particles are exhaled, and 100% of the deposited dose is absorbed.
6. The soil is highly erodible and, therefore, presents the possibility of unlimited erosion.
7. All soil is bare and therefore potentially contributes to fugitive dust emissions.

Using the above assumptions, intake was calculated as follows:

$$I = \frac{C_A \times IR \times EF \times ED \times BF}{BW \times AT}$$

where:

I = Chemical intake (mg/kg/day)
C_A = Chemical concentration in air (mg/m^3)
IR = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BF = Bioavailability factor, which assumes 50% of all inhaled particulates are subsequently exhaled, and 100% of inhaled particulates are absorbed.
BW = Body weight (kg)
AT = Averaging time (days)

and;

$$C_A = DL \times C_S \times FI \times CF$$

where:

C_A = Chemical concentration in air (mg/m^3)
DL = Dust loading, or TSP (ug/m^3)
C_S = Soil concentration (mg/kg)
(NOTE: this value is set at the proposed soil action level for each chemical)
FI = Fraction of total measured TSP concentration which is attributable to fugitive dust
CF = Conversion factor (10^{-9} kg/ug)

Using the above equations, risk associated with inhalation of airborne cadmium sorbed to dust was calculated as follows:

C_A = 125 ug/m^3 x 73 mg/kg x .5 x 10^{-9}
= 4.56 x 10^{-6}

$$\text{Intake} = \frac{4.56 \times 10^{-6} \times 20\ m^3/\text{day} \times 350\ \text{days} \times 30\ \text{years} \times .50}{59\ \text{kg} \times 25550\ \text{days}}$$

= 3.2 x 10^{-7} mg/kg/d

$Risk_{inhalation}$ = intake x inhalation slope factor

= 4.76 x 10^{-7} mg/kg/d x 6.1 mg/kg/d-1

= 1.9 x 10^{-6}

It should be stressed that the uncertainty associated with this risk estimate for inhalation of fugitive dust is high, due to the lack of site-specific data. The approach taken is intended to be a conservative screening approach. Assumptions made have maximized the estimate of exposure or dose, which is likely to have resulted in a risk estimate that is higher than a dose that would be expected to occur in the actual population effected. Current EPA guidelines would recommend that if such a bounding (maximized) estimate is not significant, the pathway can be eliminated from further assessment (U.S. EPA. 1992. Guidelines for Exposure Assessment. federal Register 57(104):22920). EPA has defined "not significant" in this instance as "... either that it is so small relative to other pathways that it will not add perceptibly to the total exposure being evaluated or that it falls so far below a level of concern that even when added to other results from other pathways, it will be trivial."

Commentors were concerned regarding the difference between the proposed soil action level for cadmium, 73 mg/kg, and the Environmental Media Evaluation Guideline (EMEG) for cadmium concentrations in soil, which appeared in the October 1991 Draft Toxicological Profile for Cadmium, published by the Agency for Toxic Substances and Disease Registry (ATSDR). The soil EMEG for cadmium recommended by ATSDR in the draft toxicity profile was 10 ppm (10,000 ppb) for exposures of 1 year or more.

At issue are two questions; (1) what is the origin and intended use of ATSDR's EMEG values and should they be considered in the context of selection of health protective cleanup levels for a CERCLA site, and (2) why is there a discrepancy between the soil action level for cadmium in soil selected by the state (based on current EPA recommendations and guidelines) and the EMEG value published by ATSDR in the draft Toxicological Profile for Cadmium.

Role of ATSDR in Remedy Selection

CERCLA and the NCP envision an investigatory and advisory role for ATSDR. Under CERCLA, ATSDR is authorized to perform health assessments, conduct epidemiological studies, establish a registry of exposed persons, and in the case of serious health risk, establish a long-term health maintenance program. However, the lead agency at CERCLA sites has primary authority with regard to response actions. Under the NCP, ATSDR's role in hazardous substance response actions is limited. ATSDR is not given a role in the NCP sections involving removal or remedial actions. ATSDR has informed CDH that it does not, as an agency, set cleanup levels at sites, even if the site is a federal one involving the EPA. ATSDR will respond to requests for its opinion regarding whether a cleanup level, as chosen by the lead agency, is protective. ATSDR will provide a health consultation on proposed or selected action levels. However, they will not develop their own action levels for any CERCLA site.

The Public Health Assessment Guidance Manual (March, 1992) written by ATSDR states that "while a risk assessment conducted under the...RI/FS process is used to support the selection of a remedial measure at a site, an ATSDR health assessment is a mechanism to provide the community with information on the public health implications of a specific site and identify those populations for which further health actions or studies are indicated." (p. 2-5)

Origin and Use of EMEGs

EMEGs have been developed to assist health assessors in selecting environmental contaminants that need to be further evaluated for potential health effects. They are screening criteria. "If the concentration of the contaminant is in excess of the EMEG, potential exposures to that chemical should be further evaluated for their health effects....The EMEG value **should not** be used as a predictor of adverse health effects of for setting cleanup levels. Their purpose is to provide health assessors with a means of selecting environmental contaminants for further evaluation. The application of EMEGs is an early step in the health assessment process, which must also include an evaluation of site-specific exposure pathways, community health concerns, and health outcome data." (Public Health Assessment Guidance Manual, March 1992, p. 5-10) At the Globe site, the evaluation of site-specific exposure pathways, community health concerns, and health outcome data have been conducted as part of the RI/FS process.

Cadmium EMEG

To provide a thorough review of this issue, the state enlisted technical assistance from a private consultant with expertise in soil ingestion issues. The discrepancy between ATSDR's EMEG and the state's proposed soil cleanup level for cadmium (based on EPA methodology) was assessed under contract with the state by Dr. Ed Calabrese, director of the Northeast Regional Environmental Public Health Center, at the University of Massachusetts. Details of Dr. Calabrese's assessment can be found in his December 1, 1992 report, entitled "Deriving a Soil Criterion for Cadmium: A Critique of Current Approaches", available in the public portion of the Administrative Record. Dr. Calabrese's comments focused primarily on differences in the methodology used by the two agencies (EPA and ATSDR) to estimate a chronic daily exposure dose that is not expected to cause an adverse systemic health effect. This dose is called a reference dose (RfD) by EPA, while ATSDR uses the term "Minimal Risk Level" (MRL). Dr. Calabrese concluded that the ATSDR MRL included use of an inappropriate uncertainty factor that caused the cadmium MRL to be questionably low.

We have since received a memo from ATSDR clarifying that the MRL for chronic oral ingestion of cadmium, that was the basis of the EMEG published in the draft Toxicological Profile for Cadmium, is currently under review by the Agency's MRL workgroup (see December 21, 1992 memo from Jessilynn Taylor, ATSDR Chemical Manager for Cadmium to the Record, available in the public portion of the Administrative Record. A new MRL will be included in the Final Toxicological Profile for Cadmium.

Beyond the pending change in the toxicity value used to calculate a soil EMEG, it is our understanding that all EMEG values will be removed from the final toxicity profiles, scheduled to be published in 1993, due to concerns regarding their inappropriate use.

ATSDR Health Consultation

Because of concerns raised by the community, we requested a health consultation from ATSDR to address whether the cadmium soil action level proposed by the state was considered health protective. We received the health consultation, dated December 11, 1992, on December 16, 1992. The health consultation concluded that the state's proposed soil action level of 73 mg/kg was protective of human health. The health consultation, which is available in the public portion of the Administrative Record, was forwarded to members of the Community Working Group, and was discussed at public meetings conducted by the state.

Pica Child

The health consultation pointed out that the cadmium cleanup level did not include an evaluation of pica behavior, therefore the cadmium cleanup level may not be protective of a pica child, depending on the extent of pica behavior. The exposure assumptions recommended by EPA guidance in RAGS and the Exposure Factors Handbook include recommendations for a reasonable maximum exposure for soil ingestion. This factor, 200 mg/day, is considered the reasonable maximum exposure required by the NCP and was used in calculations presented in Appendix B of this ROD regarding residual risk. Because of concerns raised on this issue, we are discussing it in more detail here.

Currently, the risk assessment methodology recommended by EPA for assessing potential health hazards associated with soil ingestion does not quantitatively account for pica children - those individuals with abnormally high soil ingestion rates (EPA, 1989, Risk Assessment Guidance for Superfund, Human Health Evaluation Part A). In the past, it has generally been believed that, while soil pica exists, it is such a rare event that it is not considered quantitatively in the site risk assessment, and is not appropriate for setting a soil cleanup standard. The soil ingestion rate default value of 200 mg/day, which EPA now recommends for estimating exposure to young children (up to age 6 years), is based on actual soil ingestion studies and, therefore, is assumed to reflect a variety of mouthing behavior prevalence and soil ingestion levels, but does not apply to individuals with pica.

Studies considered by the EPA to set their recommended level of daily exposure for children under 6 years old (200 mg/day intake) include work by Binder et al. (1986), Clausing et al. (1987), Calabrese et al. (1989), Davis et al. (1990) and Van Wijnen et al. (1990). All of these studies used a tracer method to calculate daily soil ingestion rates in young children, ages 1 through 7. Study duration ranged from a single event calculation (Van Wijnen et al.) to measurements of fecal output over a 2 week period (Calabrese et al.). Of the 517 children studied by these four authors, one child was identified in the literature who exhibited extreme pica behavior. EPA's current guidelines would not be protective for this child.

It is important to note that there are still many uncertainties and data gaps in estimations of soil ingestion rates and pica behavior. One difficulty in interpreting soil pica issues is that various authors will define pica behavior in various ways. Some authors focus on any type of mouthing behavior that could lead to even small amounts of soil being ingested, while others consider pica to be only an extreme or "abnormal" magnitude of ingestion of any non-food item. Some authors will consider persistence of such behavior, while others do not. Studies have, however, consistently identified children between the ages of 15 months and 6 years as the age group most likely to exhibit pica behavior.

In order to determine whether there would be some margin of safety for children in the Globe area who may exhibit pica behavior while between the ages of 15 months and 6 years and, therefore, may ingest large quantities of soil containing 73 ppm cadmium, we have used a standard EPA intake equation and back-calculated to determine that a child could ingest several times the daily upperbound soil ingestion rate that is currently recommended by EPA (200 mg/day) for 6 years out of the total 30 year exposure period without exceeding a safe level of cadmium intake.

State-sponsored research is on-going that may help quantify soil ingestion rates where direct soil ingestion of varying amounts may occur. Because EPA's current upperbound default value for the soil ingestion rate typical of young children is not protective for the pica child (defined as extreme magnitude of ingestion of any non-food item), it will be important to review this new data as it becomes available, to ensure that the soil remedy is protective of human health.

For children with extreme pica behavior (ingestion of several grams of soil per day or more), it may not be effective or possible to deal with this behavior via soil cleanup. Because such children are likely to be at risk for many adverse health effects, besides high intake of metals, the more effective intervention would be education and information for the parents, to improve supervision, especially when their child is outdoors.

Garden Vegetables

ATSDR also noted that "Consumption of vegetables grown in cadmium-contaminated soil may result in significant increases in cadmium exposure. Health risks associated with this exposure pathway were not factored into the proposed soil cadmium action level." We have calculated expected residual risk associated with ingestion of garden vegetables; these calculations are included in Appendix B. Potential risk associated with plant uptake of metals in garden soils was estimated using plant uptake factors developed by studies conducted by the Oak Ridge National Laboratory (Baes, et. al., 1984). While these uptake factors were determined to be the best approach available in the absence of site-specific data to estimate metal concentrations in edible plants, there is a great deal of uncertainty involved in using this approach. Soil concentrations in the studies used to develop these uptake factors were quite low. Linear correlation in uptake and transfer coefficients at higher metals levels has been assumed in this analysis, but is not likely, since uptake would reach equilibrium at some point. In addition, many site-specific factors can influence plant uptake, including soil pH, cation-exchange capacity and organic matter content in soil.

Risks were calculated for exposure to root and leafy vegetables, since uptake is likely to be highest for these vegetables. Estimates of daily ingestion were taken from the EPA document titled "methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions" (EPA/600-6-90/003) (1.5 g/day and 2.5 g/day, dry weight, for children and adults, respectively, for root vegetables; 0.3 g/day and 1.4 g/day, dry weight, for children and adults, respectively, for leafy vegetables). Exposure was calculated assuming 40% of all produce eaten is home-grown.

The calculations show that no adverse effects would be expected due to exposures to soil of 73 mg/kg cadmium and ingestion of garden vegetables grown in this soil.

RESPONSES TO COMMENTS FROM THE ASARCO INCORPORATED GLOBE PLANT SITE PUBLIC MEETING OF NOVEMBER 17, 1992 REGARDING THE MEDICAL MONITORING PROGRAM, THE JACA AIR STUDY, AND SOIL RECOMMENDATIONS

The following summarizes the questions, comments, and responses made during the public meeting held on November 17, 1992. Responses to comments are by representatives of the state unless otherwise noted. Where necessary or appropriate, supplemental responses have been provided. Bracketed information at the end of each question/comment indicate the name of the commentor, their affiliation if applicable, and the page of the transcript where the comment occurs. Comments have in some instances been edited or paraphrased. The transcript of this public meeting is available for public review and will be included in the administrative record. At the beginning the meeting, Dr. Joseph Jarvis gave a detailed description of the medical monitoring advisory group recommendations. The transcript of his presentation is included in the meeting transcript. Responses to medical monitoring questions were provided by Dr. Jarvis.

1. QUESTION/COMMENT: **Is the first target group limited to people still living here? [Reis, Sierra Club, p. 25]**

RESPONSE: No. The first target group consists of anyone who has ever lived in the neighborhood or anyone who has identified themselves as being concerned about their time spent in the neighborhood as an employee of a firm or resident.

2. QUESTION/COMMENT: **Is there anything that differentiates the level of service that will be provided based on what category someone falls into or would they all receive the same level of monitoring and medical services? [Ortega, Denver Councilperson, p. 26]**

RESPONSE: The three different target populations have three different screening efforts. There is some overlap within the groups.

SUPPLEMENTAL RESPONSE: The biological testing to be provided to each target population is described in the Selected Remedy section of the ROD. Testing is described in more detail in the final Medical Monitoring Plan (December 1992, available in the public portion of the Administrative Record).

3. QUESTION/COMMENT: **If you qualify for all three target populations, would you be allowed to participate in all three? [Melick, p. 27]**

RESPONSE: The first group of people identify themselves and request service. That is the only criteria. The second group of people passively do nothing and are included in a Colorado Cancer Registry evaluation for a given area. The third group of people will be actively sought and encouraged to participate. Of course, participation is voluntary.

SUPPLEMENTAL RESPONSE: An individual could participate in all three populations, if qualified.

4. QUESTION/COMMENT: **If someone is diagnosed with a disease which can be related to one of these exposures, do we send them anywhere? Do we pay for the treatment? [Reis, p. 34]**

RESPONSE: The first level of service is a screening effort which is not diagnostic but rather an attempt to categorize people into high risk or low risk groups and explain to them what that means. If a person finds themselves in a high risk group, then there needs to be a follow-up effort to try to establish a diagnosis. In many cases in environmental medicine, establishing a diagnosis also involves establishing an exposure to the disease relationship. This provides the primary kind of intervention --removal from exposure. That is definitive treatment in most cases. One of the exceptions is lead exposure. We have recommended additional steps in treatment for lead exposure as outlined by the CDC to be included in this program.

5. QUESTION/COMMENT: **If further tests become available or are published as reliable, would they become incorporated into the program? [Massero, Rocky Mountain Environmental Strategists, p. 35]**

RESPONSE: The baseline monitoring will be done either late next year or the following year. If any information becomes available during that time to suggest that there is a better test we would consider incorporating it.

6. QUESTION/COMMENT: **Using I-70 as a cutoff will leave a lot of people who have lived here for 60, 70, or 80 years out. Why was that decision made? [Martin, p. 36-37]**

RESPONSE: The cutoff does leave those on the other side of I-70 out of some of the target populations. But the first one which is access to chronic screening is open to them as well as anyone else who is nearby and feels like they have needs to be attended to.

7. QUESTION/COMMENT: **Have there been any tests that indicate that cadmium, lead, arsenic, zinc, or whatever it is, can cause specific illnesses in children? [Martin, p. 37]**

RESPONSE: Yes. There is information particularly about lead and its effect on children. The information is not specific to this community. But in the medical literature there are a number of articles that have been published about childhood lead and its potentially adverse effects.

8. QUESTION/COMMENT: I've got two grandchildren. One is facing neurological difficulties. He's 2 months old. The other is 3. The doctors are unable to find a cause. My son and daughter-in-law are very healthy, they don't live there now, but they were raised out in the projects. Has any research or anything been done? [Martin, p. 38]

RESPONSE: This type of comment is what drove this particular set of recommendations. While the state without more knowledge is unable to respond to this type of comment on an individual basis, it is important for you and others like you to have access to a public health professional who is informed and who can provide personal answers, to the extent the medical surveillance will allow.

9. QUESTION/COMMENT: I want to know what happens if the tests that have been done during that cleanup time frame show that there's been enough risk or a health exposure to the people in this neighborhood. What kind of ongoing commitment is there to take care of addressing the health needs of residents in this community? [Ortega, p. 40]

RESPONSE: If the baseline testing and the testing during the remediation shows that there is a problem in an area that has not been remediated, then the remedy would not have been protective and it will have to go further.

10. QUESTION/COMMENT: Who decides whether the remedy is protective? [Ortega, p. 40]

RESPONSE: If after the remedy, the state believes that the remedy is not protective, the state will tell Asarco to reopen the remedy. If Asarco disagrees and believes that the remedy is protective, it is Asarco's burden to prove that the remedy does not need to be reopened.

11. QUESTION/COMMENT: I've worked in the community for over 20 years. So I have some real personal health concerns as well as, general things that are relayed to me by people who used to live in the housing project. Am I correct that in screening what you're picking up is organ damage? [Hansen, p. 42]

RESPONSE: The beta-2 microglobulin picks up an actual effect on the organ itself, the kidneys. The others are indices of exposure, not necessarily at all related to damage.

12. QUESTION/COMMENT: **So you may or may not have damage. My question is, in screening there's nothing that picks up anything that's sort of a long-term time bomb. And you're not looking at anything at the molecular level. As far as I know, there are no tests that pick that up. [Hansen, p. 42]**

RESPONSE: We looked at a variety of possibilities, particularly for lead exposure which has received a great deal of attention in the medical literature in recent years. But no one has brought any of those screening tests to the point where I feel confident that they're reliable, sensitive, and specific.

13. QUESTION/COMMENT: **Twenty years from now if we have more sensitive tests available, if we have things that can pick up molecular damage, shouldn't those of us who have had an exposure somehow through this agreement and this settlement with Asarco be protected so that should that sophistication be available in the future, we could take advantage of it? [Hansen, p. 43]**

RESPONSE: If the remedy is determined to be not protective, at some point in the future, then we can reopen it.

SUPPLEMENTAL RESPONSE: The cleanup must be protective of human health and the environment. If tests developed in the future show that the remedy is not meeting that standard, then the remedy will be reopened so that it is protective.

14. QUESTION/COMMENT: **Would it involve reopening? Can something be included now which would state, for example, should more sophisticated tests become available, they would be worked into some sort of long-term screening process? [Hansen, p. 43]**

RESPONSE: Those particular words probably will not specifically be in the consent agreement. But there are provisions on reopeners that if new scientific evidence becomes available, we can reopen the remedy. That would fall into that category.

15. QUESTION/COMMENT **Does the medical community consider a nervous system as an organ of the body? [Melick, p. 44]**

RESPONSE: Yes.

16. QUESTION/COMMENT: **Do any of these chemicals affect reproductive organs? [Reis, p. 44]**

RESPONSE: Yes. Lead is a reproductive toxin.

17. QUESTION/COMMENT: Will offspring of those tested be able to be included? [Reis, p. 45]

RESPONSE: Any person, including those in downtown Denver, who comes forward and identifies themselves as potentially affected, will receive chronic screening.

18. QUESTION/COMMENT: If five years from now it is found that the threshold goes down further for the exposure levels? Can we go back in again and get more cleanup if that's necessary or warranted?

RESPONSE: Yes.

19. QUESTION/COMMENT: Why don't you write in layman's terms, in plain, old-fashioned English? How can we comment on it if we can't understand it? [Martin, p. 52]

RESPONSE: The state wrote several drafts trying to get a document as close to conversational English as possible that still reflected accurately what needed to be said. If individuals want to come in, the state would be willing to work with them on another version.

RESPONSES TO COMMENTS FROM THE ASARCO INCORPORATED GLOBE PLANT SITE PUBLIC MEETING OF DECEMBER 1, 1992

The following summarizes the questions and comments made during the public meeting held on December 1, 1992. Our responses are included. Where noted, responses were provided at the public meeting. Bracketed information at the end of each question/comment indicates the name of the commentor, their affiliation if applicable, and the page of the transcript where the comment occurs. Comments have in some instances been edited or paraphrased. The transcript of the public meeting is available for public review and will be included in the administrative record.

1. <u>QUESTION/COMMENT</u>: **We have not been able to operate nor sell our property, and basically because of the confusion in the news media, we would like to see some definite statements made or definite plan to educate the general population who may be interested in selling property but cannot because of the perception that it is contaminated. Are we expected to let our property sit for 5 or 7 years? [Rev. Brown, Denver Southern Baptist Convention, pp 8-9; Patterson p. 50]**

> <u>RESPONSE</u>: CERCLA allows the state to require Asarco to clean up the area. The statute does not provide a mechanism for anyone, including the state, to get personal or property damages for individual citizens. For relief of property damages, the individual landowner would need to file suit against Asarco. The state intends to work with the lending community to aid in property transfers. EPA has developed educational material for another site for the lending community and to aid in property transfers. We are anticipating using that information and developing fact sheets along that line. [pp. 31-32,34]

2. <u>QUESTION/COMMENT</u>: **The plan lacks consistency with the National Contingency Plan. The plan does not provide a technical basis for determining if the preferred alternatives will mitigate the identified risk. [Donahue, Deputy Chief of Staff and Environmental Issues Coordinator for the City and County of Denver, p. 11]**

> <u>RESPONSE</u>: See Introductory Remarks regarding consistency with the NCP.

3. <u>QUESTION/COMMENT</u>: **The plan does not include carcinogenic and noncarcinogenic risks associated with the preferred alternative. [Donahue, pp. 11-12]**

> <u>RESPONSE</u>: See Introductory Remarks regarding residual risk and Appendix B of this ROD.

4. <u>QUESTION/COMMENT</u>: **There should be an analysis explaining why the preferred alternatives were selected. [Donahue, p. 12]**

<u>RESPONSE</u>: An evaluation of the alternatives based upon the nine criteria was presented on pages 16 through 27 of the Proposed Plan. The comparative evaluation was presented in a tabular format due to the large number of alternatives considered (35) and the larger number of permutations available if components of alternatives are combined. Community residents have commented that the Asarco Globe plan is already quite lengthy and complicated.

A more detailed evaluation of the alternatives based upon the nine criteria is presented in the Comparative Analysis of Alternatives section of the ROD. In addition to the narrative portion, we again chose to include a tabular presentation of this evaluation due to the number of alternatives and available permutations.

5. <u>QUESTION/COMMENT</u>: **A rationale should be provided explaining why it is not feasible to attain the goal of no more than one additional cancer case per million persons. [Donahue, p. 12]**

<u>RESPONSE</u>: The NCP establishes a risk range of 10^{-4} to 10^{-6} for risk management decisions, with the point of departure at 10^{-6}. EPA acknowledges that the point of departure of 10^{-6} does not presume that the final remedial action will or should attain such a risk level (55 Fed. Reg. at 8718, Preamble to the NCP). "EPA uses the general 10^{-4} to 10^{-6} risk range as a 'target range' within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager." (OSWER Directive 9355.0-30, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, April 22, 1991). A point within the acceptable risk range was selected based on the evaluation of background concentrations, uncertainties in risk estimates, and site-specific factors, including the effects of taking remedial actions to meet various risk levels within the risk range.

For the Globe site community soils remedy, the required action level for arsenic, 70 mg/kg, represents a protective cleanup level that falls within the acceptable risk range. Cleanup will be required to this level to ensure that all properties within the site area are cleaned to an acceptable risk level. However, the state recognizes that many residents may desire cleanup to a more protective level. The state has established that the anthropogenic upper limit of background for arsenic is 28 mg/kg. The state has included in the selected remedy an opportunity for residential properties that have contaminant levels above this background level to have their properties cleaned up. This cleanup of properties above this action level of 28 mg/kg arsenic provides the maximum practicable level of protection to the community.

For the air remedy, the selected remedy represents the best technical alternatives available to the state, while ensuring that the residual risk from the air remedy remains within protective levels. Use of HEPA filter technology is a potentially promising secondary control for point source emissions, however, a pilot test is necessary to determine the feasibility, implementability and cost of these filters in an industrial process setting. Therefore, the remedy includes the pilot testing of these controls, with subsequent evaluation after a one-year test period. The air remedy already provides for a residual risk that is within the risk range and will be health protective for non-carcinogens (systemic toxicants); if the HEPA pilot test shows that HEPAs are feasible, the remedy will provide additional risk reductions; potentially to a $1x10^{-5}$ excess cancer risk level.

6. <u>QUESTION/COMMENT</u>: One of the modifying criteria under CERCLA for the selection of the remedy is community acceptance. There is no basis by which the community can ascertain if the basic CERCLA criteria are being met. [Donahue, p. 12]

<u>RESPONSE</u>: The Proposed Plan presented an evaluation of all FS alternatives against the NCP threshold and balancing criteria. The Proposed Plan states whether each alternative is protective of human health and the environment and whether each alternative meets ARARs. These two criteria are the threshold (basic) criteria. Each alternative is also evaluated using the five balancing criteria in the Proposed Plan. The ROD presents a more detailed evaluation using the nine criteria, including the modifying criteria.

7. <u>QUESTION/COMMENT</u>: The plan should be modified to include all appropriate performance standards and risk information and then re-released for public comment or the comment period should be extended. [Donahue, p. 12]

<u>RESPONSE</u>: The Proposed Plan, for each preferred alternative, identifies that ARARs would be met. For all remedial actions, the selected remedy requires that all applicable or relevant and appropriate federal and state standards, requirements, or limitations must be met. A 30 day public comment period will be provided when the proposed Consent Decree with attached Statement of Work is lodged with the court. Public comments at that time are submitted to CDH. The state will then review and respond to the comments and submit the comments and the states's responses to the federal court.

8. <u>QUESTION/COMMENT</u>: In terms of continuing emissions from the Plant site, the risk associated with the emission cap of 162 kilograms per year cap should be specified

in the proposed plan. Extrapolating from the State Department of Health/JACA air study indicates a risk of approximately 1×10^{-4}. [Donahue, p. 13]

RESPONSE: The cadmium emissions limitation contained in the Proposed Plan is approximately equivalent to a $1x10^{-4}$ excess cancer risk ($9x10^{-5}$ by our calculations).

9. QUESTION/COMMENT: **Fugitive emissions need further evaluation, especially for cadmium emissions for which the plan only includes stack emissions. [Donahue, p. 13]**

RESPONSE: See the Introductory Remarks regarding residual risk due to fugitive dust and Appendix B.

10. QUESTION/COMMENT: **An emission level for arsenic should be included due to the potential for change in the raw material composition used in the Plant... [Donahue, p. 13]**

RESPONSE: Arsenic is an impurity in the cadmium feedstock, and therefore arsenic emissions are reduced proportionately with any reductions in cadmium emissions. CDH estimates that the residual risk due to arsenic emissions under the cadmium emissions limitation is approximately $2x10^{-6}$.

11. QUESTION/COMMENT: **The meteorological conditions used in the modeling should be evaluated by the state to ensure that to the maximum extent possible, worst case conditions are being evaluated. [Donahue, p. 13]**

RESPONSE: The JACA study modelling used two full years of meteorological data. Historic data from the site is not available. Other meteorological monitoring sites, such as Stapleton Airport, do not show good correlation to conditions at the Globe Plant. Therefore, the proposed analysis is not possible, given current data. Collection of data at the on-site tower is continuing. At some point in the future, it may be possible to conduct such an analysis. The EPA recommends that five years of data be used in pre-construction air modelling of major sources, such as power plants. The purpose of the recommendation is to allow consideration of year-to-year variation. The Asarco site currently has over three years of on-site data; five years of data will eventually be available.

12. QUESTION/COMMENT: **The state should clearly define how the cost of the HEPA filters versus the public health benefits to be gained by permanently acquiring them will be evaluated in reaching a decision regarding permanent installation. [Donahue, p. 13]**

RESPONSE: The evaluation of the HEPA filter pilot test will be based upon the CERCLA nine criteria, including the threshold criteria of overall protection of human health and the environment and compliance with ARARs. The protectiveness determination will include an evaluation of residual risk and potential for systemic effects on a site-wide basis. Controls or emissions limitations will be required such that the overall site remedy is protective for both carcinogens and non-carcinogens (systemic toxicants).

13. QUESTION/COMMENT: Regarding the cleanup of soils, according to the city's consultant, the action level for arsenic of 70 milligrams per kilogram represents a risk of 1.7×10^{-4} which is 70% greater than the EPA National Contingency Plan acceptable risk level. The level should be 40 milligrams per kilogram. [Donahue, p. 14]

RESPONSE: We are unclear as to how the 1.7×10^{-4} excess cancer risk of the comment was calculated. Using the methodologies described in the FS and the PHE, the arsenic soil level of 70 mg/kg represents an excess cancer risk of 6×10^{-5} (6 in 100,000) and the risk associated with the voluntary action level for arsenic, the upper limit of background as defined in the RI of 28 mg/kg, is 2×10^{-5} (2 in 100,000). Using current EPA RAGS guidance, the arsenic soil action level of 70 mg/kg represents an excess cancer risk of 8×10^{-5} (8 in 100,000) and the risk associated with the voluntary action level for arsenic is 3×10^{-5} (3 in 100,000).

14. QUESTION/COMMENT: The state does not explain how the residential buffer area will be composed. [Donahue, p. 14]

RESPONSE: The buffer area will include all residential areas within the 28 mg/kg arsenic isopleth. Residential areas are defined as those areas that are currently zoned as residential, and any areas that may be zoned for other use but are currently in residential use. Where properties are near the "edge" of the cleanup area, additional sampling will be conducted until the edge of the cleanup area is more clearly defined. We plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels in order to confirm this "edge".

15. QUESTION/COMMENT: Due to the nonuniform dispersion of contaminants from the Globe Plant, a stepping out approach to soil testing would not necessarily hit all the areas of contamination. [Donahue, p. 14]

RESPONSE: Air modelling conducted for the FS and for the Air Engineering Design Study both show that contamination decreases with distance from the Plant. Therefore, contaminants in soil would be expected to continuously decline with distance as well. As stated above, we plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels, including buffer action levels, in order to confirm the edge of the cleanup area.

16. QUESTION/COMMENT: **The depth of soil testing should be specified. Based on the state's own analysis which indicated that 25% of the sampled locations exceeded the action level below six inches but met it above six inches, sampling should not be limited to the top six inches. [Donahue, p. 14-15]**

RESPONSE: Sampling will be conducted at the 0-2 inch interval and the 0-6 inch interval. If action levels are exceeded in either sampling interval, the property will be remediated. See response to comment #6 below regarding the potential to exposure to soils at depth.

17. QUESTION/COMMENT: **The state's action level for cadmium is 73 parts per million, the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry adverse health effects level is 10 parts per million. The action level for cadmium should be revised if necessary. [Donahue, p. 15]**

RESPONSE: The ATSDR has developed a process for evaluating sites and evaluating health effects. The process involves a screening step when contaminant concentrations are compared to environmental media evaluation guidelines (EMEGs). They have developed an EMEG for cadmium. The EMEG is a screening level. What the EMEG does is identify substances for which you need to do further investigation. The EMEGs are nothing more than media specific comparison values used to select contaminants of potential concern. The ATSDR guidance specifically states that "EMEG values should not be used as a predictor of adverse health effects or for setting cleanup levels." Moreover, the state hired an independent toxicologist to evaluate the cadmium cleanup level and to evaluate the process by which cadmium EMEGs and EPA reference doses were developed. His preliminary report says, "It is the opinion of this report that ATSDR should not have used an uncertainty factor of 10 for interindividual variation. The no adverse effect level of 0.0022 milligrams per kilogram to date should have been retained." EPA's reference dose is actually higher than the number that was used in the public health evaluation or in the feasibility study to set the cleanup level. [p. 34-] See also Introductory Remarks regarding soil cadmium issues.

18. QUESTION/COMMENT: **Who was the toxicologist who wrote the report? [Cowles, p. 37]**

RESPONSE: The toxicologist was Dr. Ed Calabrese of the University of Massachusetts. He is a nationally recognized expert on soil ingestion. He has written several articles on cadmium and recently edited a book on air toxins which contains a great deal on cadmium. He has also just completed a five year term on ATSDR's panel of scientific advisors [p. 35].

19. **<u>QUESTION/COMMENT</u>: Is that report going to be part of the record? [Cowles, p. 38]**

RESPONSE: Yes [p. 35].

20. **<u>QUESTION/COMMENT</u>: IUBK modeling is sensitive to the amount of lead in the dust. If air emission controls reduce the lead emissions and the lead slag pile is capped, the action level for lead should be protective. If either condition is not met, additional controls will be needed. The lead slag pile must be capped or covered. [Donahue, p. 15, 17]**

RESPONSE: The site action level for lead of 500 mg/kg is based upon EPA's OSWER Directive #9355.4-02, dated September 7, 1989. In an August 29, 1991 memorandum, EPA discusses use of the uptake-biokinetic (UBK) model as a risk management decision-making aid when setting soil lead cleanup levels in residential areas. If, prior to completion of a remedial action for community soils, EPA guidance is changed to formally advise use of UBK to establish action levels for lead in soils for CERCLA remedies, this guidance will be evaluated to determine its appropriateness for this site. If determined appropriate, Asarco will either expand the area of remediation into adjacent areas not previously remediated that have a lead level between the upper limit of background (413 mg/kg) and 500 mg/kg, or obtain the samples necessary to correctly model impacts to individuals under the UBK model. This sampling will include house dust and ambient air sampling. Since this model calculates blood lead impacts, additional remediation or sampling would be limited to residential areas with soil lead levels between 413 mg/kg and 500 mg/kg. The state may at any time use UBK to evaluate remedy protectiveness under the reopener provisions.

The lead slag pile will be covered as part of the remedy.

21. **<u>QUESTION/COMMENT</u>: It is imperative that the state undertake an extensive public education process to ensure that all affected residents and businesses fully understand the options and consequences of their decisions regarding cleanup as well as regarding the importance of joining the medical monitoring program. [Donahue, pp. 15-16]**

RESPONSE: The state agrees. The state will conduct an extensive bilingual public educational effort to inform residents about the community soil remedy and the medical monitoring program.

22. QUESTION/COMMENT: **Who will decide which remedial measures will be used (soil excavation versus cover) and what criteria will be applied for meeting the decision? [Donahue, p. 16]**

RESPONSE: A model cleanup plan has been developed that includes the most permanent remedy components, with provision for selection of alternate components if the property owner chooses. This model plan is described in the Selected Remedy section of the ROD. Cleanup plans for each parcel will be developed that include the appropriate components of the model cleanup plan. These parcel-specific plans will be presented and described to the property owner. The property owner will then have the opportunity to select other options for cleanup if they desire. Any variations must be approved by the property owner. CDH will be available to describe the components of the model plan, and to answer questions. Public meetings will be held to explain factors to consider when evaluating cleanup plans.

23. QUESTION/COMMENT: **The Former Neutralization Pond is entirely dependent on very long term operations and maintenance. That is not acceptable unless the state can guarantee such ongoing efforts even if, for example, Asarco were to declare bankruptcy. [Donahue, p. 16]**

RESPONSE: Asarco and any successor will remain financially responsible for proper maintenance of the remedy and for contingencies as long as hazardous constituents remain on-site. Asarco and any successor will be required to continue to prove financial responsibility on an annual basis under criteria established by the state in 6 CCR 1007-3 Part 266 to demonstrate that it is financially able to meet these responsibilities, including all contingent remedies. If the state determines at any time that Asarco fails to meet this test, Asarco will be required to obtain a bond or similar financial instrument in an amount sufficient to meet its remaining commitments.

24. QUESTION/COMMENT: **Noting the lack of numeric performance limits, how will a decision be made about whether or not to implement the contingent remedy alluded to in the proposed plan for the Former Neutralization Pond? [Donahue, p. 16]**

RESPONSE: The plan and agreement describe monitoring requirements that will be used to determine if repairs or the contingency remedy are necessary (p.3, Principles of Agreement). In addition, the FS describes ARARs and performance standards for each alternative. The Principles of Agreement and FS are included in the public portion of the Administrative Record and are available for public review. In general, contaminant concentrations in the ground water will be required to reach MCLs through time. An inward gradient across the slurry wall and beneath the waste mass will be required. Ground water levels must be maintained below the bottom elevation of the waste materials. The waste materials will not be allowed to release significant contaminants that adversely effect groundwater quality. The slurry wall and cap containment system must continually limit ground water volumes to be collected to below design limitations. If any of these criteria are exceeded, repairs will be necessary. If exceedances continue, the contingency remedy will be required.

25. QUESTION/COMMENT: **Regarding ground and surface water, numeric performance limits should be set at drinking water maximum contaminant goals. If they cannot be met, the should indicate why and what the alternative standard is. [Donahue, p. 16]**

RESPONSE: Since MCLs exist for cadmium, arsenic, and zinc, MCLs will be established as the performance standard for the terrace drain system. Non-zero maximum contaminant level goals (MCLGs) are included as ARARs for the selected remedy. In accordance with the NCP in the preamble to Section 300.430(e)(2)(i)(B), "MCLGs of zero are not appropriate for determining the actual cleanup levels to be attained under CERCLA because CERCLA does not require the complete elimination of risk..." 55 Fed. Reg. at 8752. The points of compliance will be located in the floodplain as close as possible to where the ground water plume flows off-site, considering access issues and physical restrictions (Washington Street).

26. QUESTION/COMMENT: **The five year review should ensure that the industrial drainage ditch has not become recontaminated. There needs to be a continuing mechanism to provide ensured prevention of any future use of existing wells for drinking water or for the irrigation of edible crops. You cannot rely on the same residents staying here for the next 30 years. [Donahue, p. 17]**

RESPONSE: Surface water and sediment quality sampling will be required in the long-term monitoring program to verify that the IDD has not become recontaminated. An annual water well use survey will be conducted by Asarco to ensure that there is no future use of water wells.

27. QUESTION/COMMENT: **Performance standards must be specified which will ensure that the community soils which are used as Plant sites do not become re-entrained or cause surface or ground water contamination problems. [Donahue, p. 17]**

RESPONSE: As stated in the Proposed Plan and the Agreement in Principle, the Plant site soils remedy must not cause surface water contamination, ground water contamination, or wind-blown dust. Performance standards for percent vegetation cover, based on Colorado Mined Land Reclamation requirements, will be established. Testing will be required to establish contaminant concentrations in

Plant site soils that will not to ground water or surface water contamination. Soils that are contaminated above these levels will not be placed on the Plant site. Soil areas above any soil action levels, including community soil action levels, will be vegetated to prevent wind-blown soil movement. Additional topsoil, tilling, or soil additives will be applied to any areas that will not support vegetation such that vegetative cover is provided. Operational areas not conducive to vegetation such as roads will be paved.

28. QUESTION/COMMENT: **The state should provide certification to property owners that their property is clean following remediation. Or, if remediation is not needed, the state should provide a covenant not to sue current and future property owners and lenders following remediation. [Donahue, p. 17]**

RESPONSE: Once properties have been remedied, the state intends to provide land owners with a letter establishing that their property has been cleaned. We also plan to make available to property owners construction documentation results, including the results of testing and the extent of cleanup performed. During remedial activities, the state will work closely with property owners to inform them of the status of cleanup plans, plans for further sampling, and plans for remedial action. The state has no intention to sue community property owners for contamination related to the Asarco Globe Plant.

29. QUESTION/COMMENT: **Natural resource damages should be put in trust to be used for future testing, disposal, or other contamination-related costs, for future construction or development on residential, commercial, industrial, or public property including church property. [Donahue, p. 17]**

RESPONSE: The comment is noted and will be considered after entry of the consent decree.

30. QUESTION/COMMENT: **The issue of resources to meet the treatment needs of anyone whose health has been adversely affected by the Asarco Plant should be addressed. [Donahue, p. 18]**

RESPONSE: The Selected Remedy section of the ROD discusses follow-up to be provided for any residents with elevated biological test results. The medical monitoring portion of the Statement of Work will explicitly recognize the need for follow-up testing for any resident that has elevated levels of metals. Asarco will be responsible for follow-up testing. Asarco will be responsible for all costs associated with the medical monitoring program. Under CERCLA, our authority does not extend to claims for personal injury.

31. QUESTION/COMMENT: **Two years ago, the Denver Housing Authority vacated the Stapleton Homes in the neighborhood and demolished the site partly because of health concerns due to the Asarco Plant. Two weeks ago, the DHA had a buyer for our acres of the site. Last night that buyer informed me that they could not wait any longer with respect to the site and have chosen other options. This missed opportunity ultimately reduces the DHA's ability to provide affordable housing in the city by reducing money available. To preven. this from reoccurring, the DHA property must be included in the area slated for additional testing and possible cleanup. DHA should have the option to be included in the voluntary cleanup of arsenic to background. [Marchman, Executive Director, Denver Housing Authority, p. 20]**

> RESPONSE: The DHA property will be included in the area slated for testing. If testing indicates that cleanup is necessary, the DHA property would be eligible for voluntary cleanup.

32. QUESTION/COMMENT: **The exclusion of cadmium and even lead in the voluntary cleanup to background levels sends a mixed message to the community and others. We remain concerned that the proposed action for cleanup of the soil contamination work by metals be as low as necessary to protect the people and the environment. As lay people and as a property owner, for health and economic reasons, we are concerned about any contamination level remaining above background. [Marchman, p. 21]**

> RESPONSE: The basis for the selected soil action levels is discussed in the Selected Remedy section of the ROD. The voluntary action level for arsenic is set at a background level due to the carcinogenic nature of arsenic. For cadmium and lead, cleanup levels have been set at health-protective levels. "CERCLA does not require the complete elimination of risk or of all known or anticipated effects; i.e., remedies under CERCLA are not required to entirely eliminate potential exposure..." (55 Fed. Reg. at 8752). In general, the metals of concern are co-located, e.g., where concentrations of lead are above action levels, levels of cadmium and arsenic are also elevated. In addition, cleanup actions taken to remediate one metal contaminant will not leave the others behind; the contaminated soils, including the other contaminants will all be removed or covered.

33. QUESTION/COMMENT: **Globeville is being held hostage due to the uncertainties with respect to the cleanup. The DHA wants to emphasize its desire to see a cleanup as soon as possible so that the property may be redeveloped. [Marchman, p. 21]**

> RESPONSE: The comment is noted. We intend that cleanup will take place as soon as possible, especially for the community soils remedy.

34. QUESTION/COMMENT: **This is a predominately low income community. The issue of environmental equity is an issue of significant concern to myself as well as other people within the community. [Ortega, Councilwoman from Denver, p. 23-24; Cowles, p. 41-43]**

RESPONSE: The comment is noted. See the more detailed responses to Councilwoman Ortega's comments.

35. QUESTION/COMMENT: **I also believe there has been a lack of continuity with regard to continual staff both within the Attorney General's Office and within the Health Department. Given the fact that Asarco which is a billion-dollar company has had the continuity of having the same law firm available to them, I think that the quality of the product as well as the actual cleanup plan for the community has been somewhat compromised. [Ortega, p. 25; Cowles, p.41-43]**

RESPONSE: While it would be ideal to have the same staff representatives throughout any CERCLA project, staff turnover can be expected at any CERCLA site for both the agencies involved and for the responsible parties. Asarco and its legal council have also experienced staff turn-over during this process.

36. QUESTION/COMMENT: **The site should be placed on the NPL so that EPA can step in and require more of Asarco than the state is able to require. [Ortega, p. 25]**

RESPONSE: The comment is noted. As noted in EPA's comments, EPA is evaluating the site for inclusion on the NPL.

37. QUESTION/COMMENT: **The medical monitoring plan looks at long and short term exposures to lead, cadmium, and arsenic via inhalation and ingestion. But yet, the action levels for cadmium disregard the carcinogenic effects of cadmium in the cleanup plan for the soils. [Ortega, p. 15]**

RESPONSE: The primary route of exposure to community soils is ingestion. Cadmium is not a carcinogen when ingested. We have evaluated the residual risk due to inhalation of wind-blown dust and have concluded that the 73 mg/kg action level for cadmium is protective for both carcinogens and non-carcinogens (systemic toxicants). See Introductory Remarks regarding fugitive dust and Appendix B.

38. QUESTION/COMMENT: **In my opinion, as long as the cleanup plan continues to leave levels of contaminated soils in the ground, people in Globeville have an added property burden that no other community in the Denver metro area has to deal with. Residents will have the added cost of an environmental audit when selling property. And in most cases, once a lender sees that there are still contaminated soils, they will**

more than likely not loan money to people in the community; thus in turn doing no more than redlining. [Ortega, p. 26-27]

RESPONSE: The state anticipates developing fact sheets to assist the lending community and to aid in property transfers.

39. QUESTION/COMMENT: **Is the state willing to indemnify property owners of any liability for further cleanup of contaminated soils, and meet and communicate with the lending and real estate community to share the information that the state has declared this an environmentally safe neighborhood? If not, will the state and Asarco set up a bank from which Globeville residents and businesses can borrow? [Ortega, p. 27]**

RESPONSE: The state constitution prohibits the state from indemnifying private parties for potential liabilities. The state will provide a certificate once we have gone through the property and have cleaned it up. The certificate will indicate that it now meets what we consider health-protected levels. The state anticipates developing fact sheets to assist the lending community and to aid in property transfers. [p. 50]

40. QUESTION/COMMENT: **Will certificates be given to those properties that are tested and determined not to be contaminated? [Donahue, p. 52]**

RESPONSE: Yes. [p. 52]

41. QUESTION/COMMENT: **Communication and education should be bi-lingual. [Ortega, p. 27]**

RESPONSE: The comment is noted. Spanish/English educational efforts will be made.

42. QUESTION/COMMENT: **If this site were in your backyard, would you accept the action levels that have been recommended in this plan? [Ortega, p. 28]**

RESPONSE: Yes. [p. 34]

43. QUESTION/COMMENT: **Asarco should clean up the land, air, and water, but the state should not let Asarco stay there. They've killed too many people from pollution of the air, land, and water. I say, close them down. [Winters, pp. 28-31]**

RESPONSE: The comment is noted. The contamination at and near the Plant in soils, ground water, sediments, and the Former Neutralization Pond is the result of historic operations and would not be addressed by closing the Plant. This remedy will allow us to move forward and clean up these areas of contamination and will allow for significant reduction in air emissions via the emissions ceiling and installation of further air emission controls. Lengthy delays in the entire cleanup would result if the state were to seek a court order to close the Plant. In addition, there would be no guarantee of the success of such a lawsuit.

44. QUESTION/COMMENT: **The cleanup level that the state has established for the community soils is 73 parts per million of cadmium. The cleanup level for the Asarco Plant is 9,165 parts per million of cadmium. Why isn't the cleanup level for the Plant the same as that for the community? Winds will blow cadmium from the Plant to the community? These fugitive emissions should be a greater concern. [Cowles, Attorney for Globeville residents, pp. 39-40]**

RESPONSE: Levels that are permitted on the site are of concern if they cause exposure. While they are on the site, there is a potential exposure to workers. The Plant site action levels have been set at protective levels for workers. They are of concern to the community if they migrate through fugitive emissions. In relation to fugitive emissions, first, the state has hired Dr. Calabrese to look at the risk. Second, the state has looked at the ambient air monitoring and does not see a good correlation between total suspended particulates (TSP) and cadmium levels. Increases in dust do not correspond to increases in cadmium. This indicates that the cadmium is due more to emissions from the Plant than fugitive emissions. Third, other sites have done modeling or have estimated risk due to metals concentration in wind blown dust. The levels of risk in those studies is small, less than the level that EPA considers of concern. So, while the state plans to evaluate the number, the state does not anticipate that the risk due to fugitive emissions will be significant.

45. QUESTION/COMMENT: **$2 million for natural resource damages is an inadequate amount to compensate for just one feature of the contamination --the underground water. [Cowles, pp.40-41]**

RESPONSE: One million dollars in natural resource damages will be paid. The comment is noted.

46. QUESTION/COMMENT: **Walling off the contaminated aquifer is not consistent with the National Contingency Plan. It is not consistent with the standards adopted in white communities in this country. [Cowles, p. 41]**

RESPONSE: See the Introductory Remarks regarding the ground water remedy.

47. QUESTION/COMMENT: **What type of sampling program is planned? [Cowles, p. 44; Ortega, p. 45]**

RESPONSE: The state has considered sampling similar to what EPA is doing in East Helena, dividing each property in four and taking samples from each section. If a sample is elevated, that section will be cleaned up. Sampling will be conducted at the 0-2 inch interval and the 0-6 inch interval. If action levels are exceeded in either sampling interval, the property will be remediated.

48. QUESTION/COMMENT: **When will the sampling program be defined? [Cowles, p. 45]**

RESPONSE: The scope of the work that will be part of the consent decree will spell out that a certain amount of sampling has to be done and a sampling plan has to be provided. It should be defined sometime in 1993.

49. QUESTION/COMMENT: **What kind of public comment is going to be allowed to review that scope of work so that you all can receive some feedback on that? [Ortega, p. 46]**

RESPONSE: The scope of work will be attached to the proposed consent decree which the state will lodge with the court. There is a 30 day comment period on the consent decree and the scope of work. Notices will be sent out as they have in the past.

50. QUESTION/COMMENT: **Where should comments on the consent decree and scope of work be sent? [Ortega, p. 46]**

RESPONSE: Comments should be sent to CDH.

51. QUESTION/COMMENT: **When will the air remedy be put in place? [Rev. Brown p. 49]**

RESPONSE: Several portions of the air remedy are for portions of the Plant that are not currently in operation. Those additional air pollution devices must be installed if the Plant chooses to put those portions of the Plant back into operation. The high efficiency particulate air filters will be pilot tested which will start as soon as the consent decree is signed.

52. QUESTION/COMMENT: **The property owners are being prevented from using their property. Their property has been devalued. Should not the state consider some kind of tax re-evaluation on these properties? It has been done for the presence of asbestos by petitioning the local tax authority. [Rev. Brown, p. 52; Patterson, p. 53]**

RESPONSE: Under CERCLA, our actions are limited to cleanup related costs, and do not extend to claims for property damage. The state is not authorized to act on behalf of individual citizens, but rather on behalf of the general public. For local tax matters, we suggest you contact your local city or county government.

53. QUESTION/COMMENT: **Asarco has not had the same attorneys the entire time. I have only been involved for a year or so in this case. I do represent companies, individuals in white neighborhoods; for instance, the Aspen neighborhood, the Leadville neighborhood, a number of other neighborhoods. I would like to know what white neighborhood gets better representation than this neighborhood because I've been involved on the other side in all of those places, and I have never seen a better job done than this. The average cost of the cleanup nationwide runs on the order of 26 to 28 million. This cleanup will be 38 million and with the contingencies may run another 16 million on top of that. There will be reopeners. I believe that you will not find an area that has been studied more intensely or longer or that there are powers that exist that have not been exercised here. Asarco and the state agreed to apply the National Contingency Plan and to apply that to the letter. This is a settlement. This is not something to Asarco's liking. This goes far beyond what Asarco believes is necessary. There are no contingencies that have not been looked at. There are no levels of contamination that have been determined to be unsafe. We have looked at fugitive emissions. That Plant site has a very extensive fugitive control plan. Some areas will be paved. Some areas will be vegetated. You will not have what you've had in the past in the way of blowing dust. [Connery, Attorney for Asarco, pp. 54-56]**

RESPONSE: The comment is noted.

54. QUESTION/COMMENT: **What will trigger the right of the state to reopen and say 73 parts per million of cadmium was not enough in the neighborhood. Is it going to 10? [Cowles, pp. 56-57]**

RESPONSE: Generally, reopeners have two provisions: one for new scientific evidence that becomes available after the remedy is agreed on. And another is for unknown conditions. If EPA or some other public entity determines in the future that 73 parts per million is not a health-protective level, that would constitute new scientific evidence. Now, Asarco may disagree with that. But we will have conditions in the consent decree to address that. We will probably have to go before an arbiter to discuss that. But the burden will be on Asarco to show that the remedy does not need to be changed.

55. QUESTION/COMMENT: **What if people that have property in this neighborhood and have been certified to have safe property sell their property? And new scientific evidence comes out. Now you have got someone that bought property that is contaminated that supposedly wasn't five years ago? [Reis, p. 58]**

RESPONSE: If there is scientific evidence that indicates the remedy is not protective, the reopener provisions of the Consent Decree will be triggered.

56. QUESTION/COMMENT: My mother and my family lived in this community for a long time. There has not been adequate notification of meetings. The residents of Globeville should be relocated to a safe environment before anything else. [Molock, pp. 61-64]

RESPONSE: The has conducted extensive notification throughout the RI/FS/Proposed Plan process. The state has compiled a mailing list of over 600 individuals who are notified for each major meeting. This list is updated with the attendance sheets from each meeting. In addition, a working group mailing list of approximately 70 individuals is maintained for those interested in more frequent meetings concerning the site. The state believes that it will not be necessary to relocate residents during the remedial actions.

57. QUESTION/COMMENT: This is a thriving residential community. It's not a transient neighborhood by any means. People that live in this neighborhood have been here for generations. Most people want to make sure that the cleanup is performed properly so that they can stay in the neighborhood and feel safe. The cleanup should be performed so that the health and safety of the community is assured and that property values are not a concern. [Ortega, pp. 64-65]

RESPONSE: The comment is noted. The state intends to see that the cleanup is performed properly.

58. QUESTION/COMMENT: Even if they don't have one now, the residents of Globeville ought to be able to dig a garden if they want to after the area is cleaned up. [Donahue, pp. 65-66]

RESPONSE: The remedial plan for community soils is protective. Contamination in the community soils is predominantly located at or near the ground surface, due to being caused by windblown contaminants. Removal and replacement of up to 12 inches of soils in community yards should both remove most of the contamination and prevent exposure to any remaining contamination. The additional 18 inches in gardens provide a safety factor. In addition, any resident within the community soils remediation area who desires a new vegetable garden area can request soil sampling at a 12 inch depth. If the sampling indicates that contaminant levels exceed action levels, clean soil will be provided to a depth of 18 inches. This program is described in more detail in the Selected Remedy section of the ROD.

COMMENTS OF ADAMS COUNTY SUBMITTED BY ELAINE T. VALENTE, CHAIRMAN, BOARD OF COUNTY COMMISSIONERS

General Comments

Of primary concern is the fact that the plan is deficient in information concerning the detail and scope of the proposed cleanup. For example, the degree of sampling and oversight monitoring provided by independent State Health officials is unspecified.

See Introductory Remarks regarding level of detail in the Proposed Plan.

A second concern is that some of the proposed cleanup levels do not meet the requirement of CERCLA and its amendments, despite the fact that Asarco has previously agreed to such remediation goals.

See Introductory Remarks regarding consistency with the NCP.

The County also disapproves of the permanent disposal of contaminated solids and sediments on site. Such disposal will limit future use of the property. Likewise, the specter of future toxic releases will always remain.

CERCLA disfavors the off-site transport and land disposal of untreated waste materials. Before community soils can be placed on site, they will be tested to ensure that they will not contribute to ground water or surface water contamination. Vegetation and surface water controls will be provided to prevent wind and water erosion of the soils. Future use of the property will be limited by deed restrictions. These deed restrictions will allow industrial/commercial use of the Plant property. The Plant property has been zoned by Adams County for industrial use.

Lastly, the County remains concerned that the proposed plan is not complete with respect to air pollution controls sufficient to achieve a one-in-one-million risk. The contribution by fugitive dust has been ignored, and the point source controls barely achieve a 1 x 10 -4 risk.

For the air remedy, the selected remedy represents acceptable technical alternatives that are available to the state, while ensuring that the residual risk from the air remedy remains within protective levels. The air remedy already provides for a residual risk that is within the risk range ($9x10^{-5}$) and will be health protective for non-carcinogens (systemic toxicants); if the HEPA pilot test shows that HEPAs are feasible, the remedy will provide additional risk reductions. The Air Engineering Design Study estimated that reductions to the $1x10^{-5}$ excess cancer risk level could be achieved if the HEPA filter technology is feasible. Since other portions of the remedy can go forward while the HEPA filters are pilot tested, we chose to go forward rather than delay the entire site remedy for the results of the pilot test.

Specific Comments

Former Neutralization Pond

The proposed action of entombing the pond, with monitoring by Asarco, does not present a permanent solution to the possibility for future toxic releases. How frequently will the system be monitored? How long will the monitoring system be maintained? Who will provide independent oversight monitoring of the constructed liner and slurry wall, as well as the leachate detection system? How will this monitoring be conducted, or otherwise assured financially, in the event Asarco becomes bankrupt 50 years from now? How is this proposal a long-term solution?

The NCP recognizes that remedies may be selected that result in hazardous constituents remaining on-site, especially where large volumes of waste exist. For example, landfill remedies typically involve capping of waste that remains in place. These remedies less frequently include installation of slurry walls and drain systems. The ARARs for the Former Neutralization Pond remedy include monitoring frequency, record-keeping, and analysis. These ARARs will be met. See the response to U.S. EPA comments for a more complete discussion of the Former Neutralization Pond remedy with regards to ARARs. The Statement of Work will describe the long-term monitoring to be conducted at the site. The state will provide independent oversight of remedy construction and monitoring. CERCLA requires five-year reviews of remedies where hazardous substances remain on-site, to ensure that the remedy remains protective of human health and the environment. Should any five-year review, or interim review, indicate that the remedy is no longer protective, the state will re-evaluate and the contingent remedy may be triggered.

Asarco and any successor will remain financially responsible for proper maintenance of the remedy and for contingencies as long as hazardous constituents remain on-site. Asarco and any successor will be required to continue to prove financial responsibility on an annual basis under criteria established by the state in 6 CCR 1007-3 Part 266 to demonstrate that it is financially able to meet these responsibilities, including all contingent remedies. If the state determines at any time that Asarco fails to meet this test, Asarco will be required to obtain a bond or similar financial instrument in an amount sufficient to meet its remaining commitments.

Ground Water/Surface Water
The drain system to collect and then treat ground water to 10 ppm may not be adequate to protect the health and safety of downstream entities. Why will a waiver to the Maximum Contaminant Levels (MCL) established by the Safe Drinking Water Act, be granted?

Collected ground water will be treated at the Plant wastewater treatment plant. After treatment, the water will be discharged to 1) the sanitary sewer under Asarco's existing wastewater treatment permit (treatment must meet existing permit requirements); 2) surface water per CoPDES permit requirements (treatment as necessary to meet permit limitations); or 3) through underground injection (treatment must meet MCLs). In no case would a waiver of MCLs be necessary or granted.

During the remediation, which is expected to last 100 years, how will the state provide for the protection of well and water users in the area?

See Introductory Remarks regarding the ground water remedy.

The proposal to monitor water quality of the Farmers and Gardeners Ditch rather than mitigate the problem raises the same questions as before: What is the proposed frequency of the sampling plan? How will there be a (financial) guarantee that adequate monitoring will remain in place for the long term? Who will provide the long-term independent oversight monitoring, and at what frequency?

The problem in the Farmers and Gardeners Ditch has already been mitigated through repairs and a pilot drain system that lowers the ground water table in the area where the Ditch crosses under Washington Street. The completed terrace drain should ensure that Farmers and Gardeners Ditch water does not become recontaminated. Monitoring of water quality will be provided as a protective measure to ensure that the water does not become recontaminated. Sampling frequency will be detailed in the Statement of Work. Asarco will be financially responsible, as described above, for long-term monitoring. The state will provide oversight of the monitoring program.

Community Soils
Action levels established for cleanup of arsenic and cadmium contaminated soil do not meet EPA's acceptable risk level of 1 x 10 -4 despite the fact that Asarco has previously agreed to such remediation goals. At a minimum, these levels must be achieved. What will be the depth of testing? Who will, and how will, the remedial action (excavation, capping, exposure controls, and/or deep tilling) be decided for each location? What monitoring will be available to assure that fugitive dust created during the soil removal process will not contaminate already cleaned sites?

We are unable to duplicate Adams County's evaluation of residual risk levels for the community soils remedy. Using the methodologies described in the FS and the PHE, the arsenic soil level of 70 mg/kg represents an excess cancer risk of $6x10^{-5}$ (6 in 100,000) and the risk associated with the voluntary action level for arsenic, the upper limit of background as defined in the RI of 28 mg/kg, is $2x10^{-5}$ (2 in 100,000). Using current EPA RAGS guidance, the arsenic soil action level of 70 mg/kg represents an excess cancer risk of $8x10^{-5}$ (1 in 10,000) and the risk associated with the voluntary action level for arsenic is $3x10^{-5}$ (3 in 100,000).

Sampling will be conducted for a 0-2" and 0-6" intervals. If either sampling interval exceeds action levels, the property will be cleaned up. A model cleanup plan has been developed that will be used as the basis for community soil cleanup. The model cleanup plan is described in the Selected Remedy section of the ROD. The model cleanup will be modified as necessary based upon discussions with the property owner. Site-specific ambient air monitoring will be conducted during community soils remediation activities to ensure that fugitive dust is not a problem, in addition to the on-going long-term ambient air monitoring program.

The proposed soil cleanup plan is too vague. Without more specific testing program available for review, how are we assured that the plan will provide for adequate soil cleanup, and provide a long-term solution?

Decisions regarding whether properties will require cleanup will be made based upon sampling conducted on the individual properties. Additional property-specific sampling will be conducted to further delineate the edges of cleanup areas. While the sampling conducted in the RI/FS was sufficient to describe contaminant patterns, we will need to confirm the boundary of cleanup through additional sampling. Where properties appear to be near the "edge" of the cleanup area, additional sampling will be conducted until the edge of the cleanup area is more clearly defined. We plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels in order to confirm this "edge". As described above, sampling will be conducted for a 0-2" and 0-6" intervals. If either sampling interval exceeds action levels, the property will be cleaned up. A model cleanup plan has been developed that will be used as the basis for community soil cleanup. The model cleanup plan is described in the Selected Remedy section of the ROD.

Plant Site

Concern remains over the higher action level (contamination level) allowed for cleanup of Plant site soils. The action level for the Plant should be the same as for adjacent residences. How will fugitive emissions be controlled in perpetuity from the site? How will downwind residences be assured that their property will remain uncontaminated

after cleanup so long as there is a potential source upwind? What performance standards for percent vegetative cover, wind-blown dust emissions and off-site sediment transport will be established to minimize fugitive emissions? How, and who, will monitor these performance standards forever?

As stated in the Proposed Plan and the Agreement in Principle, the Plant site soils remedy must not cause surface water contamination, ground water contamination, or wind-blown dust. Performance standards for percent vegetation cover, based on Colorado Mined Land Reclamation requirements, will be established. Testing will be required to establish contaminant concentrations in plant site soils that will not to ground water or surface water contamination. Soils that are contaminated above these levels will not be placed on the Plant site. Soil areas above any soil action levels, including community soil action levels, will be vegetated to prevent wind-blown soil movement. Additional topsoil, tilling, or soil additives will be applied to any areas that will not support vegetation such that vegetative cover is provided. Operational areas not conducive to vegetation such as roads will be paved.

The First Amendment to the Agreement in Principle/Principles of Agreement contains specific details regarding land use restrictions. Asarco will be required to file a written instrument containing a land use restriction with the appropriate entities within 30 days after entry of the Consent Decree. This recorded instrument shall be binding on Asarco, its successors and assigns, and will include provisions for access and enforcement by the state and reasonable prior notification to the state of any change in land use that may result in the remedy no longer being protective of human health and the environment. If the state determines that such a change in land use would cause the remedy to no longer be protective of human health and the environment, further land use restrictions may be imposed and/or additional remedial actions may be required by the state. Oversight monitoring will be provided by the state.

No remediation has been proposed for the lead slag pile. How will fugitive emissions be controlled in perpetuity form he pile to protect adjacent residences from contamination? This pile must be contained or removed to prevent fugitive emissions from undermining already completed remediation work.

The comment is noted. The lead slag pile will be covered to prevent fugitive emissions.

The data used to predict fugitive emissions from similar smelter operations located outside Colorado may not be appropriate for use. A weak correlation with total suspended particulates and cadmium levels at other sites does not mean that a strong correlation is not present at the Asarco Globe site. Did the fugitive emission data

contain wind episodes equivalent to 90 mph on an annual basis, similar to the "Chinook" winds along the Front Range? Did the other sites have poor control of dust emissions from the buildings, as found at this Plant? Were similar site conditions (percent cover, exposed slag piles, etc.) in place as will be used at the Globe site?

A review of the Asarco ambient air monitoring shows little or no correlation between TSP levels and cadmium concentrations. This lack of correlation is consistent throughout the ambient air monitoring that has been performed at the Globe site, over five years of data. In addition, when the Plant was not operating during the summer of 1991, cadmium levels dropped to very near lowest detectable levels.

The Plant site remedy includes additional controls of fugitive emission sources, including negative pressure recorders for Plant buildings, repair requirements, etc. In addition, percent vegetative cover requirements will be established for vegetation and the slag pile will be covered.

Stabilization of the sediments from the former sedimentation pond does not present a permanent solution to the possibility for future toxic releases. How frequently will the system be monitored? What will the governing performance standards be? Who will provide independent oversight monitoring in perpetuity? How will this monitoring be conducted, or otherwise assured financially, in the event Asarco becomes bankrupt 50 years from now? How is this proposal a long-term solution? What are the performance standards for the contingency remedy? Will soils be disposed off-site or on-site?

A monitoring plan for the former sedimentation pond will be specified in the Statement of Work. The performance standards for the stabilized sediments will be MCLs. The state, unless authority is delegated to the County, will provide independent oversight. A discussion of site-wide financial responsibility is provided above. Materials will be disposed of on-site, unless off-site disposal of treated materials is cost-effective. On-site or off-site disposal will meet all substantive regulatory requirements.

The limit of cadmium emission to 162 kg/yr. from point sources is not health protective. This number does not quite meet the EPA risk standard of 1 x 10 -4. We believe this number should be limited to an equivalent risk standard of 1 x 10 -6 since inputs to the atmosphere from fugitive emission have not been included. This creates an even less health protective number that falls outside the CERCLA range Asarco agreed to meet. Will the risk standard for all cadmium emissions be achieved (hazard index of 1)? If not, why not?

The cadmium emissions limitation contained in the Proposed Plan is equivalent to a $9x10^{-5}$ excess cancer risk, essentially the same value as $1.1x10^{-4}$ as Adams County has calculated and $8.6x10^{-5}$ by our calculations.

The state believes that the HEPA filter technology is a promising technology and that using this technology, emission reductions to lower the residual risk level may be feasible. The Air Engineering Design Study estimated that reductions to a $1x10^{-5}$ excess cancer risk may be possible through use of HEPA filters.

There is currently no EPA reference concentration (RfC) for cadmium available to evaluate the hazard index associated with cadmium emissions. However, CDH understands that EPA is currently in the process of developing a RfC for cadmium inhalation such that a hazard index can be calculated. The evaluation of the pilot test will include an evaluation of remedy protectiveness, including an evaluation of the hazard index associated with cadmium emissions, if possible. If a hazard index can be calculated, a hazard index of 1.0 or less will be achieved.

Why is there no monitoring for arsenic point source emissions as well as fugitive dust?

Arsenic is included as an analyte in the ambient air monitoring program. Arsenic will also be included as an analyte for any stack testing that is conducted. Arsenic is an impurity in the cadmium feedstock, and therefore arsenic emissions are reduced proportionately with any reductions in cadmium emissions. CDH estimates that the residual risk due to arsenic emissions from current operations is approximately $2x10^{-6}$.

Should there not be a lead emissions stack test performed to determine if the pollution controls can reduce lead point source contributions?

Lead emissions from the Plant currently meet all federal and state standards. The additional cadmium emission controls will reduce lead emissions from any lead impurities in the cadmium feedstocks, however, no additional pollution controls are required under CERCLA for the litharge and test lead sources. The Colorado Air Quality Control Commission retains independent authority to determine appropriate controls for hazardous air pollutants such as lead.

What controls will be make available to minimize emissions from thallium, indium and cadmium sulfide should such processes come on line? What provisions would be in place to monitor the effectiveness of the controls? Control to what standard, or risk equivalent, would be achieved?

The Proposed Plan states that should these processes become operational, their contribution to Plant emissions would be evaluated and the controls available to minimize these emissions would be analyzed. Appropriate protectiveness goals will be evaluated at that time. The Colorado Air Quality Control Commission also has independent authority to determine appropriate controls for emissions from these processes. The goal of the CDH Air Pollution Control Division is a $1x10^{-6}$ excess cancer risk.

How will the State Health officials monitor the HEPA filter costs vs. their benefit? The scope of work for this decision process should be established prior to the evaluation.

The evaluation of the HEPA filter pilot test will be based upon the CERCLA nine criteria, including the threshold criteria of overall protection of human health and the environment and compliance with ARARs. The protectiveness determination will include an evaluation of residual risk and potential for systemic effects on a site-wide basis. Controls or emissions limitations will be required such that the overall site remedy is protective for both carcinogens and non-carcinogens (systemic toxicants).

Attachment 1 of the First Amendment to the Agreement in Principle/ Principles of Agreement describes the methodologies to be used in conducting the HEPA filter pilot test; these methodologies include the right of the state to independently verify HEPA cost data and efficiencies. In addition, the state will be present during the installation of the pilot HEPA, performance of stack tests, maintenance of the system, and filter change-outs. The First Amendment to the Agreement in Principle/ Principles of Agreement, as well as the Agreement in Principle, is available in the public portion of the Administrative Record and has been made available to Adams County.

By restricting the future use of the Plant site property and by not treating or removing all sources of contamination, how has a permanent sacrifice area not been established within the border of Adams County? Adams County is concerned that the basis of the cleanup plan is of contaminant containment rather than actual treatment and removal of the sources of contamination. The defilement of our soil, ground water and air is an injustice that must be rectified, in a timely and thorough basis. At some point in time, it becomes more economical to both Asarco and the State Health Department to permanently remove or treat a contaminant source rather than provide for long-term monitoring. The state may want to explore this further, particularly in the event that long-term monitoring may well fall into their hands.

The state disagrees that the Plant site will become a "sacrifice area", and Asarco obviously considers the area to be economically viable. Though deed restrictions will be imposed that limits Asarco or its successors to similar or more protective uses of the site, the limitation will not prohibit future industrial or commercial use. The NCP recognizes that remedies may be selected that result in hazardous constituents remaining on-site, especially where large volumes of waste exist. For example, landfill remedies typically involve capping of waste that remains in place. These remedies less frequently include installation of slurry walls and drain systems. CERCLA requires five-year reviews of remedies where hazardous substances remain on-site, to ensure that the remedy remains protective of human health and the environment. Should any five-year review, or interim review, indicate that the remedy is no longer protective, the state will re-evaluate and the contingent remedy may be triggered.

Asarco and any successor will remain financially responsible for proper maintenance of the remedy, for long-term monitoring, and for contingencies as long as hazardous constituents remain on-site. Asarco and any successor will be required to continue to prove financial responsibility on an annual basis under criteria established by the state in 6 CCR 1007-3 Part 266 to demonstrate that it is financially able to meet these responsibilities, including all contingent remedies. If the state determines at any time that Asarco fails to meet this test, Asarco will be required to obtain a bond or similar financial instrument in an amount sufficient to meet its remaining commitments.

In conclusion, the Asarco Globe Plant continues to threaten the health, safety and welfare of residences and business in our County. The county remains concerned that many of the details in the proposed cleanup plan are not of sufficient detail and scope to make informed decisions. Nonetheless, Adams County urges the Colorado Department of Health to aggressively proceed with the portions of the proposed settlement agreement that are immediately implementable. Installation of the HEPA filters, and many other remedial activities such as Plant housekeeping improvements, and installation of the ground water extraction and treatment system, should be pursued immediately, rather than allow remediation to be delayed while the scope of work for sampling and selecting performance standards is undertaken.

The comment is noted. The state intends to expedite those portions of the remedy that can be readily implemented. See the Introductory Remarks regarding level of detail in the Proposed Plan.

COMMENTS OF ASARCO

Asarco supports the Proposed Plan because it will clean up impacted areas, protect public health and the environment, and benefit the Globeville community. Attached as Exhibits A and B are documents containing factual and technical information that support the evaluation and selection of the remedial measures in the Proposed Plan. These include documents not previously submitted to the state, as well as existing documents that may not yet be included in the Administrative Record. Asarco requests that both Exhibits be made part of the Administrative Record; provided, however, that Exhibit A contains confidential documents subject to the Order Protecting Confidentiality, dated December 10, 1990, in the case of Colorado v. Asarco, and should therefore be included in the confidential portion of the Administrative Record.

The comment is noted. The referenced documents will be incorporated into the Administrative Record for the site.

Consistent with the Memorandum of Agreement dated March 30, 1987, between Asarco and the State of Colorado (the "state"), the Globe Plant site has been comprehensively studied, remedial measures evaluated, and the Proposed Plan issued strictly in accordance with the National Contingency Plan. These studies include a Remedial Investigation, which identified the nature, extent and scope of contamination, a Feasibility Study, which evaluated alternative remediation techniques, and a Public Health Evaluation ("PHE"), which evaluated public health risks.

The National Contingency Plan, ("NCP") which was consistently applied in this case, requires a very conservative approach to develop remedies that are fully protective of human health and the environment, with an ample margin of safety. As provided in the NCP, the Proposed Plan integrates applicable or relevant and appropriate requirements under federal and state environmental laws, and provides protection of public health and the environment by substantially reducing the potential for exposure to pollutants and risks related to such exposure.

The comments are noted. The state agrees that the RI/FS and remedy selection process have been conducted in accordance with the NCP, that the remedy is protective of human health and the environment, and that the remedy complies with the substantive provisions of all applicable or relevant and appropriate federal and state requirements.

The risk assessment methods used in this case to evaluate public health risks and select remedial measures are based on extremely conservative, worst-case assumptions that inherently tend to overpredict actual risk. For example, risk calculations in the PHE were based on numerous conservative assumptions, including the following: (1) that residents would consume 2 liters per day of contaminated ground water every day for 70

years; (2) that persons living near the Plant would be continuously present in the their homes, never leaving to go to work, school, shopping or traveling, for a full 70-year lifetime, and breathing contaminated air the entire time; (3) that 50% of all vegetables consumes by residents over a 70-year lifetime would come from gardens near the Plant with elevated levels of metals; and (4) that children would play in the Industrial Drainage Ditch for 3 hours per day, 3 days per week, 26 weeks per year, for 10 years, despite the fact that it is surrounded by a fence. Obviously, these assumptions are hypothetical only, and do not reflect actual conditions.

Additionally, the PHE expressly states that numerous other assumptions used in the risk assessment result in overestimation of risk, including the following: (1) the use of short\term concentrations to estimate maximum plausible exposures for the air and vegetable pathways; (2) the use of ambient air data at the Plant boundary to estimate risk beyond the Plant boundary; (3) the use of data from laboratory experiments using high doses on animals to extrapolate risks associated with low doses in humans; (4) the use of 95% confidence limits as a upper-bound estimate of risk. The PHE, in fact, expressly provides that "the conservative assumptions used in estimating exposures... help ensure the actual risk is less than the calculated risk" (at page 82). Because of the inherent conservatism of risk assessment methodology, we can be confident that the Proposed Plan will actually be far more protective of public health than is predicted by risk assessment calculations.

Included in the attached documents are two letters written by Dr. Joyce Tsuji, Ph.D., D.A.B.T., Senior Toxicologist for Kleinfelder, regarding risk associated with the Globe Plant. The first deals with the subject of risk associated with inhalation of dust contaminated with metals, a subject raised during public meetings on the Proposed Plan. Dr. Tsuji concludes that risks related to this pathway are not significant. The second letter addresses the subject of the calculated cumulative risk associated with the Proposed Plan, and confirms that the cumulative risk is within the acceptable risk range described in the NCP.

The state performed its own evaluation of risks associated with inhalation of dust contaminated with metals. The results of this evaluation are discussed in the Introductory Remarks of this Responsiveness Summary, and have been included in the Administrative Record.

EPA policy for conducting risk assessments recommends that the overall exposure estimate be conservative, but within a realistic range of exposure. This includes assessment of all reasonably expected exposures, and reasonable maximum exposure durations. The state reviewed the Public Health Evaluation conclusions using currently available EPA guidance methodologies (Risk Assessment Guidance for Superfund, December 1989) and exposure factors (Exposure Factors Handbook, July 1989, Exposure Assessment Methods Handbook, 1989, and

OSWER Directive 9285.6-03, Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors). This review demonstrated that although there have been changes in both exposure variable values and toxicity values, the resulting hazard quotients and excess cancer risks do not differ significantly between current guidance and previous guidance. Conclusions regarding whether remedial actions are required are the same.

The state agrees that the assumptions used to estimate exposures in the risk assessment process tend to be conservative in order to ensure that actual risk to an exposed individual is likely to be less than the risk calculated for a hypothetical individual. However, the state disagrees that the approach taken to assess risk and select remedial measures is based on "extremely conservative, worst-case assumptions." A risk assessment based on "worst case assumptions" would imply that every exposure parameter selected would have been maximized, which is not the approach recommended under current risk assessment guidance. Parameters selected, in fact, are based on current state-of-the-art knowledge about what represents a reasonable upper-bound value for a hypothetical distribution for each exposure parameter, based generally on national averages. This approach is often the best one available, in the absence of more precise, site-specific data for an affected community.

Hypothetical risk calculations are only one way to demonstrate that the Proposed Plan is conservatively protective of public health and the environment. There also have been empirical health studies conducted in the Globeville community, and these studies have not found any significant adverse health impacts to residents that could be attributed to past operations has been identified, and because the Proposed Plan will greatly reduce the level of past exposure to pollutants, the community should be reassured that the Globe Plant will not cause them any harm in the future.

In addition to being conservative, and therefore exceeding what is necessary to protect public health and the environment, the Proposed Plan provides a significant benefit to the Globeville community--the cleanup of community soils--that would not be achievable in the natural resources damages lawsuit between the state and Asarco. In this lawsuit, the state could not obtain injunctive relief to compel Asarco to perform cleanup work. Colorado v. Idarado Mining Co., 916 F.2d 1486, 32 ERC 1001 (10th Cir. 1990). And the Court also could not award the state damages for injury to private property. At most, the state could be awarded "natural resource damages" for injury to public resources. Ohio v. Dept. of Interior, 880 F.2d 432, 459-461 (D.C. Cir. 1989). Therefore, soil cleanup on private property can only be achieved through settlement of the lawsuit.

Such a settlement is described in the Agreement in Principle between the state and Asarco, which requires Asarco to implement the Proposed Plan, including the cleanup of community soil, if the Court approves a Consent Decree incorporating the measures set

forth in the Proposed Plan. Certainly, Asarco and the state will benefit from a final settlement by avoiding continued litigation. However, the public will also benefit, by achieving the cleanup of community soils as well as remediation of the other operable units.

> The comment is noted. While we disagree as to whether the state could obtain soil cleanup on private property through litigation, we believe that the state and the Globe area residents benefit from a final settlement and avoiding continued litigation.

Asarco would like to respond to comments made at the December 1, 1992 public hearing regarding the Proposed Plan, by Mr. Macon Cowles, attorney for the plaintiffs in the case of Escamilla v. Asarco, Civil Action No. 91-CV-5716, Denver District Court, asserting that soil on the Globe Plant property should be cleaned up using the same action levels that apply to community soils. Mr. Cowles' claim was that supposedly highly contaminated soil from the Plant property has been, and will continue to be, blown into the surrounding neighborhood by persistent winds, and that this poses a serious health problem. He also alleged that this problem was documented in Asarco records, but said that he could not discuss those records further because they were subject to a Court order making them confidential.

Because of Mr. Cowles' false assertions, Asarco withdrew its motion for and order preserving the confidentiality of these records, previously filed in the case of Escamilla v. Asarco. Asarco believes these documents must be made part of the public record to demonstrate that Mr. Cowles has misrepresented their content.

Copies of these documents are included as Document No. 10 in Exhibit B, enclosed with this letter, for you review and examination. Contrary to Mr. Cowles' assertion, these documents do not indicate any kind of health risk to the community from Plant soil or blowing dust.

Some of the "confidential" documents are more than 50 years old, and all of them are more than 20 years old. During the last 20 years there have been significant changes in the Globe Plant material handling and production process, including: (a) cadmium dust is now shipped to the Plant in "super sacks," rather than in bulk, (b) since June, 1991, no "dust" has been shipped to the Plant at all, and only cadmium metal has been received for refining, (c) the refining process has been changed from a pyrometallurgical to a hydrometallurgical process, which reduced the potential for air emissions, (d) a sophisticated water treatment plant was constructed and operates, eliminating the need for the neutralization pond which was capped and revegetated, and will be further capped and remediated under the Proposed Plan, (e) all cadmium-bearing byproduct is now stored, prior to shipment, in the former Godfrey Roaster Building, rather that outside, (f) the "cadmium losses" referred to in some of the enclosed documents are not

physical losses of cadmium, but rather inventory accounting "losses"; differences between inventory coming in and product going out can be attributable to many factors, including measurement and sampling errors, and moisture content of the product.

Moreover, as you pointed out at the public hearing on December 1, 1992, there is no correlation between total suspended particulate and air-borne cadmium, which clearly indicated that blowing dust is not a significant source of air-borne cadmium. Finally, much of the soil on the Plant property that was previously exposed has been paved over or vegetated in the past decade, and additional dust control measures, including vegetation or paving, are required under the Proposed Plan.

> *The comments are noted. The referenced documents will be incorporated in the* public portion of the Administrative Record.

Regarding ground water quality, in early 1991, the Colorado Water Quality Control Commission proposed to classify certain ground water in the Denver Metro segment of the South Platte River corridor for "domestic' and "agricultural" use, and to set water quality standards for that ground water which were far more stringent than its existing quality. After receiving extensive comments from numerous parties and holding a lengthy public hearing, the Commission modified its proposed rule and adopted instead a rule setting water quality standards for these ground waters based on the less stringent of (1) the existing quality as of October 30, 1991, or (2) the state's Basic Standards for Ground Water. In adopting this rule, the commission recognized that much of this area has been used for many years for industrial purposes, and that contamination from industrial activity, as well as agricultural and urban runoff, and naturally occurring soluble salts has negatively impacted the ground water quality in a large part of this area. It also recognized that this ground water is not being used as a drinking water source.

The enclosed report from Wright Water Engineers was submitted as evidence in the rulemaking proceeding before the Commission, and confirms that the quality of ground water in the South Platte River Corridor is generally poor. It also confirms that this ground water is not currently used for drinking water purposes, and is used only to a limited extent for lawn watering and similar purposes.

Because of the degraded quality of ground water in this entire South Platte River segment, even if the plume associated with the Globe Plant were treated more aggressively the ground water in this area would still not be usable as a drinking water source. The existing poor ground water quality, coupled with the provision in the Proposed Plan for institutional controls to prevent public use of this ground water, support the ground water remedy included in the Proposed Plan, specifically including reliance on natural flushing to restore the quality of contaminated ground water in the flood plain. As you know, it now appears that this restoration will be accomplished

more rapidly than estimated in the Feasibility Study.

The comments are noted. The state recognizes that the interim narrative standard for ground water within the saturated zone of the unconfined portions of the Denver Basin Aquifer system is the less restrictive of the existing ambient quality as of October 30, 1991, or the basic ground water quality standard. The interim narrative standards have been included as ARARs for the site remedy.

Finally, some speakers at the public meetings expressed concern about exposure of local residents to metal-contaminated dust during residential soil remediation, and asked whether the residents should be relocated while remediation work is in progress. Based on its knowledge of several soil remediation projects in other communities, Asarco believes that relocation of residents during remediation is not supported.

Asarco is aware of soil remediation projects in East Helena, Montana, Dallas, Texas, Kellogg, Idaho, and Salt Lake City, Utah where soils containing lead, cadmium, and arsenic were remediated and neither EPA nor local regulators required relocation of residents, or deemed it necessary. Additionally and more importantly, no adverse health impact from remediation has been noted in these communities, because reasonable precautions have been taken by remediation contractors in handling and removing contaminated soil.

For example, in the town of East Helena, high volume monitoring for total suspended particulate and lead showed no discernable change during the construction season. Additionally, monitoring of employees of remediation contractors showed no exceedances of the occupational exposure standard for lead or arsenic during performance of the work. Because ambient levels, as monitored by the high volume samplers, and occupational exposures are both unremarkable, Asarco believes that relocation of residents during remediation near the Globe Plant is unnecessary.

The comments are noted. The state has independently contacted project managers for Superfund sites that are conducting or planning to conduct residential soils cleanup. The state is not aware of a residential soils cleanup under CERCLA where relocation of residents has been recommended.

It should also be noted that the medical surveillance planned in the Globeville area during remediation exceeds any monitoring done in these other communities, and that this surveillance will provide an additional measure of protection for the community.

The state agrees that the medical monitoring program will provide additional protection for the community. In addition, we are unaware of any other CERCLA site that provides an equivalent or greater level of monitoring to be provided to Globe area residents.

For these reasons, and for the reasons evaluated and described in the Proposed Plan, the Feasibility Study and the Administrative Record, Asarco has agreed to the Proposed Plan, and believes that it should be incorporated into a Consent Decree and approved by the Court. Asarco hopes that such a Consent Decree will be approved soon, so that work can begin on the actual cleanup.

The comment is noted.

COMMENTS OF DONAVAN D. BEVLAQUA

As I understand the cleanup plan, industrial and commercial sites will be tested and cleaned up to action levels; the residential land owners have the option of cleanup to lower action levels. Why would you not support giving industrial and commercial land owners the same options of soil cleanup? You are concerned about residents living at the lower levels, so why are you not concerned about people working in the same levels? Employees, especially outdoor industrial yard workers, are exposed to at least as much if not more dust and dirt as residents.

The required site action levels are the same for both residential and commercial properties. These action levels are based on residential exposure estimates and are more conservative than the exposures that are likely to occur to commercial property workers. The additional "buffer" cleanup offered in residential areas is primarily intended to provide additional protection for sensitive individuals, such as young children.

We own an office building, warehouse and storage yard just southwest of Asarco and have already experienced trouble leasing parts of our site due to the media stories and rumors regarding pollution problems in the area.

The comment is noted. The state filed suit under CERCLA in order to get the site cleaned up. Under CERCLA, our actions are limited to cleanup related costs, and do not extend to claims for personal injury or property damage. The state is not authorized to act on behalf of individual citizens, but rather on behalf of the general public.

Whenever warranted, we need positive media coverage that lets people know the problems are being worked on and the area is a safe place to live and work.

As remediation takes place, the state will work with the media to make sure they understand that the area has been cleaned up.

We need a document or certification from you stating that our property has been tested and if necessary, cleaned. I doubt that many residential or industrial sites in the area will be marketable until buyers see a certification that the property is free of pollution and is safe.

Once properties have been remedied, the state intends to provide land owners with a letter establishing that their property has been cleaned. We also plan to make available to property owners construction documentation results, including the results of testing and the extent of cleanup performed. During remedial activities, the state will work closely with property owners to inform them of the status of cleanup plans, plans for further sampling, and plans for remedial action. We will also be available to work with area lenders to clarify cleanup related issues.

COMMENTS OF CLEAN WATER ACTION, submitted by CARMI MCLEAN

The Asarco Globe Plant site is contaminated from decades of smeltering. Given this public health danger to our most vulnerable population in particular, we find serious fault with the proposed plan for cleanup at the Asarco Plant site.

The proposed plan depends on containment and diversion strategies rather than cleanup plans for the Former Neutralization Pond and ground/surface water. It also assumes that Asarco will be around to do the monitoring of this contaminated water until the end of time. At the very least, the pond needs numeric performance limits to determine the implementation of any contingent plan. At the very least, numeric performance limits should be set at drinking water Maximum Contaminant Level Goals (MCLG) and there needs to be a continuing monitoring mechanism to assure the prevention of any future use of existing wells for drinking water or for crop irrigation. Because of the nature of surface and ground water the only adequate clean up plan is not containment but rendering this water to the quality standards of being harmless for human consumption.

The NCP recognizes that remedies may be selected that result in hazardous constituents remaining on-site, especially where large volumes of waste exist. For example, landfill remedies typically involve capping of waste that remains in place. These remedies less frequently include installation of slurry walls and drain systems. The long-term monitoring to be conducted and the performance limits for the Former Neutralization Pond is described in the Selected Remedy section of the ROD. MCLs and non-zero MCLGs have been established as performance standards for the Former Neutralization Pond and for the ground water remedy.

The contaminant plume is well-defined, does not endanger other aquifers in the Denver metro area, and will almost certainly not be used as a water supply in the future. The well installation prohibition is a further assurance that the ground water will not be put to use. Installation of water wells within the contaminated portions of the floodplain aquifer is prohibited by Rule 10.2.2 of the rules of the State of Colorado's Office of State Engineer State Board of Health, State Examiners of Water Well Construction and Pump Installation Contractors (revised effective July 30, 1988). Asarco, with state oversight, will conduct an annual well survey in the contaminated plume to assure that no one is using existing wells for drinking water or for irrigation purposes.

Asarco and any successor will remain financially responsible for proper maintenance of the remedy and for contingencies as long as hazardous constituents remain on-site. Asarco and any successor will be required to continue to prove financial responsibility on an annual basis under criteria established by the state in 6 CCR 1007-3 Part 266 to demonstrate that it is financially able to meet these responsibilities, including all contingent remedies. If the state determines at any time that Asarco fails to meet this test, Asarco will be required to obtain a bond or similar financial instrument in an amount sufficient to meet its remaining commitments.

We feel the basis or action levels for soil cleanup is simply too high and is 70% greater than the EPA NCP acceptable risk level and does not meet the goals of CERCLA. Because lead seems to be the most pervasive contaminant, we feel soil action levels should be based on lead throughout the entire area. Surely you jest about vegetable gardens.

The comments are noted. The state believes that the soil action levels are health protective, are within the NCP risk range, and meet the goals of CERCLA. Any Globe site community soils exceeding the lead action level (based upon EPA guidance) will be remediated.

The most troubling aspect of the Asarco "clean up" plan is dealing with incineration and emissions of these substances. We are strongly opposed to any incineration which will, of course, cause emissions of these deadly metals. Incineration simply means more soil and water contamination.

It is not clear what incineration the commentor is referring to. The Asarco Globe remedy does not include an incineration component.

At the very least, cadmium should be specified in the proposed plan. Fugitive emissions need further evaluation. Since the cadmium emission limit is only for the stack emissions, if the fugitive emissions are underestimated, then the combination of both the stack and fugitive emissions will need to be considered. Emission limits for arsenic are not even included. What consideration has been given to worst case weather factors such as temperature inversions?

Cadmium action levels are specified for the community soils remedy. A cadmium limitation has been placed on emissions from the Plant. Fugitive emissions were evaluated in the FS and in the Air Engineering Design Study. These studies also used on-site meteorological data that included incidence of temperature inversions.

Arsenic is an impurity in the cadmium feedstock, and therefore arsenic emissions are reduced proportionately with any reductions in cadmium emissions. CDH estimates that the residual risk due to arsenic emissions from current operations is approximately 2×10^{-6}.

There are other human costs involved. Residents will be monitored and analyzed according to the plan, but nowhere in the plan is there any consideration for medical treatment as a consequence of this health hazard. Where do residents seek medical treatment and who pays the bill? The property of residents living in the affected area is worthless. Nowhere in the proposed plan does it provide for compensation for lost value of property.

> The state filed suit under CERCLA in order to get the site cleaned up. Under CERCLA, our actions are limited to cleanup related costs, and do not extend to claims for personal injury or property damage. The state is not authorized to act on behalf of individual citizens, but rather on behalf of the general public.

A meaningful Asarco clean up plan needs to consist of:
1) Cleanup of ground and surface water to drinking water standards, not just containment of these waters.
2) Soil clean up at reasonable action levels which take into consideration the most pervasive metals as well as the most pervasive substances.
3) Instead of including incineration and emissions as a solution which it is not, emphasize clean up of water and soil.
4) Asarco should not only fund medical treatment for residents but compensate residents for the lost value of their property.

> As noted above, ground water will be cleaned up to drinking water standards (MCLs) through collection and treatment of terrace ground water, collection and treatment of Former Neutralization Pond ground water, and natural attenuation of the floodplain ground water. Surface water contaminants are not elevated above background conditions. Soil action levels are protective and have been set on health-based levels. The remedy does not include incineration. Under CERCLA, the state's actions are limited to cleanup, and do not extend to claims for personal injury or property damage.

Please include this statement in the public record and we would be most interested in a reply.

> All comments are included in the public portion of the Administrative Record and are available for review. All commentors will receive copies of the Responsiveness Summary.

SUMMARY OF COMMENTS FROM MACON COWLES

I. Introductory comments

Background levels for arsenic, cadmium and lead are falsely elevated, reducing the apparent level of contamination which can be attributed to Asarco.

Background issues were addressed in detail in the final RI. The following is a general overview of background issues.

The term "background" is often used to refer to a naturally occurring concentration. However, in an urban environment, with a multitude of man-made contributions, naturally occurring concentrations (background) are extremely difficult or impossible to determine. For the purpose of this RI, the term "background" was used to identify the concentration of each metal above which contamination can be attributed to the Globe Plant. This is called the "upper limit of background" in the RI.

Soil samples taken from beyond a one mile distance may, in some cases, be affected by contamination due to the Plant, and therefore are not necessarily a measure of background conditions. The mean concentration from samples taken beyond one mile is included for comparison purposes and shows that contamination decreases with distance from the Plant.

Background levels, whether in an environment undisturbed by people or in a city with many sources of contamination (urban background), are represented by a range of values, rather than a single number. When attempting to distinguish the impacts of the Globe Plant from those of the surrounding urban environment, there is no single concentration level that is an absolute indicator of contamination due to the Globe Plant. It is not appropriate to use the average or mean background concentration as an indicator of impacts due to the Globe Plant because, by definition, approximately half of the background concentrations will be higher than this value (without any contribution from the Globe Plant). While no exact (or single) concentration can be identified that would differentiate between a background concentration and one impacted by the Globe Plant, the "upper limit of background" concentrations that are presented in the RI are approximately equal to the mean background concentration, plus one standard deviation (a standard deviation is a measure of the variability of the values). Theoretically, about one third of the background concentrations, without any impact from the Globe Plant, would still be higher than the mean plus one standard deviation, so it is not the true upper limit of background concentrations. Thus, soils in some areas with concentrations exceeding the "upper limit of background" value may not have been impacted by the Globe Plant.

Soil background levels are site-specific, in that background levels of metals vary from site to site depending on location, geologic conditions, and proximity to other pollutant sources. Background levels for the Asarco Globe site do not represent, and should not be used as background for other sites. Both background levels and health effect levels can be considered when setting soil cleanup levels. However, background levels cannot be set in relation to the health effects of the metals, since background levels are dependent on soil conditions, both naturally occurring and man-made, and are not dependent on health effects of soil contaminants.

The state has chosen soil action levels for cadmium which are contrary to ATSDR guidance. The state was ignorant of the cadmium EMEG at the time it set the action level at 73 ppm, and is resorting to hindsight rationalizations from Asarco. The state ignored or quoted out of context ATSDR guidelines concerning EMEGs.

CDH has had a cooperative agreement with ATSDR for several years to conduct health assessments at various Superfund sites in Colorado, and has been aware of ATSDR methodologies for health assessments and environmental media evaluation guidelines (EMEGs). The last published table of ATSDR EMEGs included soil EMEGs of 200 mg/kg for acute exposure and 350 mg/kg for chronic exposure. CDH was aware of and had reviewed the most recent draft Toxicity Profile for Cadmium published by ATSDR prior to publication of the Proposed Plan; in fact, copies of this document were distributed to the Medical Monitoring Advisory Group in the summer of 1992. Because EMEGs are not intended to be used as action levels, CDH did not consider the previous cadmium EMEG or the draft cadmium EMEG value when selecting the cadmium soil action level. EMEGs are intended to trigger more in-depth review in an ATSDR health assessment. Parallel methodology has been developed by EPA for use in quantitative risk assessments for CERCLA sites. The EPA methodologies were used by CDH when conducting the Public Health Evaluation. This process identified cadmium as a contaminant of concern; cadmium was retained in the risk assessment. Specific guidance is provided by EPA to be used in setting appropriate action levels for contaminants of concern. This guidance was used by the state.

Rather than "hindsight rationalization", the state, consistent with the public participation instructions and spirit of the NCP, acted in response to public concerns. Immediately after the cadmium EMEG issue was raised, the state re-evaluated the cadmium soil action level and the assumptions used to develop this level. We also hired an independent toxicologist to review the ATSDR and EPA methodologies. We asked ATSDR to provide a clarification of the intended use of EMEG values. We asked ATSDR to perform a health consultation on the cadmium action level and to determine if the level was protective of human health. We requested that ATSDR attend a public meeting to clarify EMEG issues for members of the public. Each of the reviews reaffirmed that the selected cadmium soil action level of 73 mg/kg is protective of human health.

See also the Introductory Remarks regarding the role of ATSDR and the intended use of EMEGs.

II. The ATSDR Toxicological Profile

Because of ATSDR's statutory mandate to prepare toxicological profiles for each substance listed as the most significant hazardous substances at Superfund sites, and because of its expertise, its recommendations concerning safe soil levels must be given great weight. CDH and Asarco have ignored the ATSDR guidelines and asserted that they are incorrect. The October 1991 ATSDR draft Toxicological Profile for Cadmium concluded that to provide adequate protection for all persons, including the most sensitive or susceptible persons, based on Minimal Risk Levels (MRL), the Environmental Media Evaluation Guide (EMEG) for cadmium in soil was 10 ppm for human exposures for 1 year or more.

As stated in the Introductory Remarks, EMEGs have been developed to assist health assessors in selecting environmental contaminants that need to be further evaluated for potential health effects. "If the concentration of the contaminant is in excess of the EMEG, potential exposures to that chemical should be further evaluated for their health effects....The EMEG value **should not** be used as a predictor of adverse health effects or for setting cleanup levels. Their purpose is to provide health assessors with a means of selecting environmental contaminants for further evaluation. The application of EMEGs is an early step in the health assessment process, which must also include an evaluation of site-specific exposure pathways, community health concerns, and health outcome data." (Public Health Assessment Guidance Manual, March 1992, p. 5-10) (emphasis supplied by ATSDR) At the Globe site, the evaluation of site-specific exposure pathways, community health concerns, and health outcome data have been conducted as part of the RI/FS process.

The fact that ATSDR, in its draft Toxicity Profile for Cadmium, had preliminarily recommended an EMEG value for cadmium is <u>not</u> a conclusion that the EMEG should be used as an action level "to provide adequate protection for all persons, including the most sensitive or susceptible persons...." Instead, the EMEG value is a flag used at the beginning of the health assessment process to indicate that site specific factors should be evaluated in more detail. The state provided this detailed evaluation throughout the RI/FS process. Although this detailed evaluation had already been completed, in response to concerns raised by the public, the state re-evaluated the cadmium action level as described above and concluded that the cadmium action level is protective.

ATSDR places principal reliance on a long term study by Nogawa which calculated a cadmium total body burden which would produce renal injury, and then calculated how much daily exposure would lead to that body burden and added an uncertainty factor of 10 to arrive at the Minimum Risk Level (MRL) and the EMEG of 10 ppm of cadmium in soil.

The comment is noted. ATSDR has since reviewed the MRL and will be revising the MRL value upwards to allow a somewhat higher safe daily dose (memo from Jessilyn Taylor, ATSDR is available in the public portion of the Administrative Record.) The revised MRL will be published in the final Toxicological Profile for Cadmium.

The state's analysis by Calabrese, which agrees with that of Kreiger, Asarco's expert, is a post facto justification of the chosen action level. Their analyses concluded that the Nogawa data were broad enough that no uncertainty factor was needed since all sensitive people or susceptible people would be included in such a broad based study.

Dr. Calabrese had no contact with Dr. Kreiger and did not review Dr. Krieger's deposition. The state contracted with Dr. Calabrese, an expert in soil ingestion and cadmium issues, to provide an independent review of differences between ATSDR methodologies used in setting the cadmium MRL and the EPA methodology used in setting the cadmium RfD. Dr. Calabrese recently completed a five year term on the ATSDR board of scientific advisors. ATSDR, in their review of the cadmium MRL, also questioned the uncertainty factor of 10 that had been included in the draft Toxicological Profile.

The following studies and ATSDR statement should be considered in the determination of action levels and may indicate that a cadmium level equivalent to the ATSDR EMEG for cadmium in soils include: •

Buchet, et al., "Renal effects of cadmium body burden of the general population", Lancet 1990 Sep 22;336(8717):699-702

Lauwerys, et al., "Does environmental exposure to cadmium represent a health risk? Conclusions from the Cadmibel study," Acta Clin Belg 1991;46(4):219-25

ATSDR has indicated that nutritional status of children may affect cadmium impact.

Bernard, et al., Assessment of urinary protein 1 and transferrin as early markers

of cadmium nephrotoxicity," Br J Ind Med 1990 Aud;47(8):559-65

Roels, et al. "Urinary kallikrein activity in workers exposed to cadmium, lead or mercury vapour," Br J Med 1990 May; 47(5):331-7

Roels,et al. "Health significance of cadmium induces renal dysfunction: a five year follow up," Br J Ind Med 1989 No ; 46(11):755-64.

Staessen, et al. "Transfer of cadmium from a sandy acidic soil to man: a population study," Environ Res 1992 June: 58(1):25-34

To be consistent with the NCP, the state utilized EPA methodologies and EPA toxicity factors. EPA, when it developed the current RfD for cadmium, considered a great deal of information and studies. The Integrated Risk Information System (IRIS) process periodically reviews new scientific literature in an on-going iterative process. The state has no role in developing RfDs and was not involved in the development of the cadmium RfD. The state, however, has reviewed the studies listed above, and has found no basis to challenge the EPA RfD. Should future reviews by EPA's working group result in a different RfD, the state will review the remedy to ensure that it is health-protective.

The state recognizes that nutritional status of children may affect cadmium impact. Part of the development of RfDs includes application of appropriate uncertainty factors to account for potential differences in sensitive subpopulations, including nutritional status. The state will address nutritional issues on an individual basis in its educational efforts and follow-up to the medical monitoring program.

III. The ATSDR Public Health Assessment Guidance Manual and How CDH Tried to Use It

The state took one page from ATSDR's March 1992 Public Health Assessment Guidance Manual out of context. "The EMEG values should not be used as a predictor of adverse health effects or for setting cleanup levels. Their purpose is to provide health assessors with a means of selecting environmental contaminants for further evaluation. The application of EMEGs is an early step in the health assessment process, which must also include an evaluation of site-specific exposure pathways, community health concerns, and health outcome data." In most instances, there are factors which would suggest that the goal should be a cadmium concentration lower than the EMEG, not higher. At this site, because there is re-entrainment and airborne contamination, causing inhalation exposure and cadmium loading, there is an argument to be made that the EMEG should not be used as the soil cleanup level, because it may too high. Where there are additional routes of exposure in addition to soil ingestion, the EMEG,

based only on the soil ingestion uptake models, may not cover all the cadmium exposure that a person may have.

The state disagrees. The quote was used in context (see Introductory Remarks regarding the origin and intended use of EMEG values).

In general, ATSDR recommends that if concentrations of a contaminant are below EMEG values, the health assessor should eliminate them from consideration. However, ATSDR, in the current Public Health Assessment Guidance Manual (March 1992), states that "other factors, such as multiple exposures, synergistic effects, and community health concerns may require including the chemical as a contaminant of concern." (p. 5-10) The state reiterates that cadmium was considered a contaminant of concern throughout the RI/FS process, and that a detailed evaluation of site-specific exposure pathways, community health concerns, and health outcome data was conducted.

IV. Exposure routes were not adequately studied. Exposure from fugitive emissions was not considered at all.

Potential risk associated with fugitive emissions has been considered. See Introductory Remarks.

CDH relies too heavily on airborne emission data. The RI/FS ignored evidence from Asarco records which show tremendous cadmium losses from fugitive emissions, dust on transport, and ventilation. Fugitive emissions and re-entrainment from wind should be evaluated.

Historical emissions are reflected in community soil concentrations. The community soils remedy addresses contamination due to historical emissions. The best measure of current emissions, including fugitive emissions and wind-blown dust, is ambient air monitoring. The state currently has over five years of ambient air monitoring data. Fugitive emissions and re-entrained dust have been evaluated and will be addressed in the Plant site remedy.

Monitors are too high in the air to measure ground level breathing zone re-entrainment.

The majority of cadmium in the ambient air is believed to be a result of Plant site emissions. Therefore, locating the air monitors at higher elevations maximizes the amount of cadmium measured, e.g., monitoring performed at ground level would have lower readings.

The height of the samplers was based upon EPA guidelines and the requirements detailed in the "Ambient Air Monitoring Requirements for the Air Pollution Control Division of the Colorado Department of Health." Specifically, the following APCD requirement was followed:

> ... All particulate sites shall be selected so that they are at least two meters, but not more than 15 meters above the ground. Sites shall be oriented in a manner that will minimize the influence of unpaved roads or other obvious point sources. The sampler shall be free of obstructions in the near vicinity. Gaseous and particulate sites shall be selected so as to meet EPA siting criteria ... (Ambient Monitoring Requirements for APCD CDH, January 1989).

The samplers were located to provide a representative measurement of the ambient air in the general area, and to ensure that obstacles, such as buildings and vegetation, did not shield the samplers and reduce measured concentrations.

Fugitive emissions from on-site soils will be detected at higher monitoring site elevations, particularly during high-wind events. Although measurements made at human contact levels are optimal for assessing risk, the monitors detect the majority of fugitive particulates.

The state directed its consultant for the Air Engineering Design Study to evaluate the placement and height of the ambient air monitors. The siting parameters used by the state and Asarco were compared to siting criteria established by EPA in 40 CFR Part 58, Appendix E. The siting of the operating monitors is in accordance with EPA optimum siting criteria.

EPA Risk Assessment Manual requires looking at all exposure pathways, including indoor dust and outdoor soil.

Current EPA guidelines for soil ingestion rates are assumed to representative of exposure to both indoor dust and outdoor soil. This guidance was used in developing residual risk estimates. By assessing risk for 350 days per year, it is assumed that the exposure from indoor dust is equal to the exposure to outdoor soil. See Introductory Remarks regarding residual risk.

Because cadmium, arsenic, and lead all accumulate in the body, reliance on only soil ingestion is an incomplete analysis of all additive pathways for each metal. EMEG based on just soil exposure would thus possibly be too high, not too low.

Additive pathways for the contaminants of concern were considered. See Introductory Remarks regarding residual risk, EMEG issues, and Appendix B of the ROD.

V. CDH response to comments on PHE

Both inhalation and direct ingestion of dust contribute to the increased cadmium exposure and the relative contribution of both sources is similar. See Buchet, Roels, Lauwerys 1980 study.

Both inhalation and direct ingestion pathways have been considered. More recent literature indicates that the relative contribution from inhalation is less than that of direct ingestion, although this will vary based on site-specific soil and ambient air concentrations.

Now even the monitoring advisory group has recommended that 10 ppm be the footprint for designation of at-risk population. Their report and recommendations confirm what we have been saying, and which has been ignored, that persons are at risk from exposure to cadmium concentrations of 10 ppm in soils. See also Teitelbaum affidavit.

The final Globeville Medical Monitoring Program - Advisory Group Final Recommendations for Action states that "Targeting a geographic area delineated by the cadmium background soil contour will provide a reasonable buffer zone around the area of likely future soil remediation, and will also serve as a reasonable surrogate for historical exposures. It is important to note, however, that the exposure footprint delineated represents a geographical area thought to be much larger than the area which would represent a highly exposed target population. It is expected that selecting such a broad geographical area will have the advantage of being able to distinguish between background exposures and site-related exposures, if any are identified." The boundary selected for the medical monitoring program was specifically selected to include a population that would not be expected to demonstrate site-related exposures.

One purpose of the medical monitoring program is to respond to individual's health concerns, including the concerns of those who are not believed adversely affected by the site.

VI. Reentrainment

One of the largest issues raised by the City of Denver and not at all addressed at any point in any of the documents is the question of re-entrainment of cadmium and arsenic in the soil and dust. This issue has not been addressed or considered at all in the soil cleanup action level of 73 ppm they apparently are basing that exclusively on an

ingestion component. It is a problem because the reentrainment of soil dust is not considered at all as an additional loading into the kidneys and as an additional component of the total airborne emissions. To accurately measure exposure, all three inhalation exposure pathways must be considered: airborne emissions from the stacks, fugitive emissions, and the reentrainment of cadmium and arsenic that is already in the soils. Those must be combined with all ingestions for an increased cadmium body burden. That is completely ignored through the RI/FS and in responses.

See the Introductory Remarks regarding residual risk due to fugitive dust and Appendix B. The ambient monitoring data reflects contribution from airborne emissions from the stacks, fugitive emissions, and the re-entrainment of soils. This data was included in the PHE evaluation of site risk. The state has not considered exposure to re-entrained dust to be a primary exposure route. However, due to concerns raised by the community, we have estimated potential risks due to windblown dust. This evaluation is presented in the Introductory Remarks section.

VII. Medical Monitoring Committee

Of interest and great concern is the fact that in the general response to public comments published by CDH in April of 1992, it is stated that the Public Health Evaluation is not intended to assess the health of individuals who live in the area and who may be effected by any contamination.

An assessment of the health of individuals who live in the area is the normal function of an ATSDR health assessment. As stated in the final PHE, "The PHE clarifies what exposure pathways act as potential sources of risk, defines whether the risks posed by those pathways are significant enough to warrant remedial measures, and provides a methodology for determining levels of chemicals that can remain on-site and still be adequately protective of public health. The PHE cannot and is not intended to quantify the actual past, present, or future adverse health effects which the Globe site may have caused. The PHE does provide an estimation of current or potential health risks that the site may cause under assumed exposure conditions, and identifies the exposure pathways of concern for these risks."

Further, Dr. Teitelbaum has testified that the exposure studies done by Karen Gottlieb have serious flaws. This kind of assessment was said to be more properly done by medical monitoring.

All ATSDR-funded studies go through an extensive peer review process, both within ATSDR and through independent scientific evaluation. Since the commentor does not specifically identify flaws, we cannot respond further. A medical monitoring program will be provided as part of the selected remedy.

When the independent medical advisory committee gave its recommendations, it made two important statements which are ignored by Asarco and the CDH in their report to the public on action levels. At page 6 of the medical monitoring draft it says that for the target population of medical monitoring, the advisory group recommends using the area that falls within the 5 X 10 to -6 air risk contour and refers to Figure 1 to define the population at risk of excess cancer due to inhalation of "smelter emissions and re-entrained dust." The group goes on to recommend that all community members living within this "footprint of exposure" should be assessed as a group for evidence of excess incidence of cancer. It is important to note that they have then in Figure 1 given a contour that shows where they consider an excess cancer risk of 5 X 10 -6 based not only on airborne emissions, but also on re-entrained dust, so they are clearly considering re-entrained dust to be an important component of the overall cancer risk. Looking at Figure 1 in the Medical Monitoring Advisory report, it clearly encloses the entire class action definition of residences and probably most of the 10 ppm soil isopleths contour. The report goes on to talk about non-carcinogenic risks and the group recommends the use of the soil contour associated with the concentration for cadmium of 10 ppm to define a geographic area of concern or exposure footprint for non-carcinogenic health outcomes which may be associated with oral exposure from ingestion of contaminated soil and dust. It then says that all community members living within this "exposure footprint" should be assessed for current, ongoing and chronic exposures. In other words, although in April of 1992, CDH takes the position that they have adequately studied health risks and that 73 ppm for cadmium is all they need to consider; and while they did not in any way consider re-entrainment of airborne emissions as a possible cancer risk, they refer to the need for medical monitoring. The medical monitoring takes a completely opposite position and adopts a much broader level for action or concern.

See response above regarding the selection of the medical monitoring program boundaries.

VII. Additional Comments

1. Without fugitive emissions data prior to February 1988, there was no working basis for the RI/FS or PHE and no data upon which to base a true and accurate risk assessment.

The PHE is not intended to evaluate historical health impacts. The NCP, at 300.430(d)(4) states that the agency should conduct a "risk assessment to characterize the current and potential threats to human health and the environment that may be posed..." (emphasis added) See above for a discussion of the purpose of the PHE. The RI/FS and PHE conclusions were appropriately based upon ambient air monitoring data.

2. Asarco first proposed in February of 1988 a soil action level of 120 ppm for cadmium only, the PHE had not been finalized, indicating that Asarco had already determined what soil action level they wanted for cadmium.

Soil action levels are developed based on methodologies used in the PHE, and not based upon the final numerical risk estimates of the PHE. In addition, we note that the draft PHE was issued prior to the draft FS that contained the first action level alternatives. The PHE was finalized prior to the finalization of the FS. The draft FS contained an action level of 73 ppm of cadmium, rather than 120 ppm.

3. When the PHE was resubmitted in November 1988, it is difficult to believe that it was a baseline evaluation of risk not incorporating any remedial activities that had been done or may be done that would likely reduce the health impact. Again, without some data upon which to base all potential risks of exposure to all environmental media for all four metals of concern prior to 1986 or even 1988, the PHE must be suspect as an unbiased tool to evaluate the current risk.

The PHE reflects data collected in all media and characterizes current and potential risk, rather than historical risk. See response to item 1, above.

4 - 7. These comments summarize PHE process.

The comments are noted.

8. Throughout the period of time in which the parties prepared the PHE, it appears that based on extensive revisions, extensive recalculations, and updated requirements, the soil action levels for cadmium had not been substantially changed from when Asarco first proposed a 120 ppm action level and its 73 ppm proposed action level in July of 1989. With so many unresolved questions about the data gathered and unsatisfactory responses, for example choice and location of ambient monitor height, it is not possible to put much faith in the final PHE. With more accurate and more inclusive data including fugitive emissions data for all sources, especially before 1986, it seems inconceivable that the 73 ppm proposed by Asarco in July of 1989 would not again be substantially decreased.

It is not clear how ambient air data on historic fugitive emissions would affect the selection of soil action levels. The underlying assumption appears to be that, through time, protective soil levels would become more conservative. This is often not the case, due to additional data collection and evaluation removing uncertainty from toxicity estimates. For example, after the draft PHE was published, the RfD for cadmium was raised from 0.00029 mg/kg/d to 0.001 mg/kg/d as more information became available. The soil cadmium action level was based upon the more conservative RfD.

9. Apart from those considerations, there is finally the consideration that the medical monitoring committee recommendations draft ... [Bill is going to fill in here] ... when 120 ppms were proposed in January of 1988, TRC report for air emissions indicated that the risk was 10 to -4 for arsenic, arsenic in soil level proposed at 28 ppm whereas by July 1989 was 1.5 X 10 -4 with the soil levels still at 28 ppm, but for cadmium where the risk initially was in the rate of 10 to -4 at 120 ppm was now in July at 1.9 X 10 -4 with 73 ppms, the range is still within 10 -4, even though the soils levels have decreased substantially by approximately 40% proposed.

We are unclear as to the concern the commentor is trying to raise. We could not find a substantive issue here that has not been addressed through previous responses.

This commentor submitted additional comments on January 26, 1993, concerning the ATSDR health consultation. Issues raised are addressed in the Introductory Remarks.

COMMENTS OF ANNETTE CUTTER

I'm writing in regards to the Asarco Smelter. My father who died of lung and esophagus cancer about six years ago had worked up there for about 20+ years. He started up there when he was 18 years old. He had worked with chemicals such as arsenic and cadmium. Once he had gotten really sick with lead poisoning and the doctors refused to tell my mother what the problems were. Now you tell me, should it be kept open. My father's name is Adolph Leustek and if you have any questions, you can talk to my mother, Amelia Leustek.

Occupational exposures often involve more severe exposures to chemical contaminants than those expected for environmental exposures. CERCLA does not provide the state with jurisdiction over occupational exposures. Because there are many potential causes of lung and esophagus cancer, it is difficult, and may be impossible, to determine if ailments are due to exposure from metals from Globe Plant emissions, if they could be due to industrial exposures during working hours, or if they are due to other causes.

Jurisdiction of air pollution issues is split between CDH/EPA, which have authority over off-site (public) exposures, and the federal Occupational Safety and Health Administration (OSHA), which has authority over on-site (worker) exposures. OSHA has recently required that Asarco install additional workplace controls, to reduce employee exposure. These include: raising the smokestacks from a height of 8 feet to 50 feet to reduce ground-level concentrations, adding better ventilation in the Premelt and Retort Departments to reduce exposure to employees working near furnaces, and improvements to the employee protection and medical monitoring programs. In 1992, OSHA adopted a new workplace standard for cadmium in air that will apply to many industries nationwide. OSHA's rationale for developing the new standard included a study that followed the health of a group of employees at the Globe Plant. (Thun, M. et al{1985}. "Mortality Among a Cohort of US Cadmium Production Workers-an Update." in, Journal of the National Cancer Institute, 74, 325-333).

For further information regarding workplace cadmium exposures, see the federal Register for September 14, 1992. This document summarizes OSHA's views and findings regarding cadmium exposure, and controls. For a copy, contact the OSHA office in Denver.

COMMENTS OF CITY AND COUNTY OF DENVER

We have an overriding concern which is directly related to the Memorandum of Agreement entered into by Asarco and the state on March 30, 1987, in which both parties agreed that the remedial action program would meet the National Contingency Plan (NCP) and satisfy the requirements of CERCLA.

Specifically, we do not believe that the Plan is consistent with the NCP, because it does not provide a technical basis for determining which of the proposed remedies will mitigate the identified risks. In addition, although the plan identifies the risks posed by the present contamination, the potential risks associated with the preferred remedies are not included. The carcinogenic and noncarcinogenic risks must be identified in the plan since all of the preferred remedies are hybrids of the alternative identified in the Feasibility Study. The state should also include a brief analysis that supports why the preferred alternatives were selected.

> The Proposed Plan and Record of Decision is consistent with the NCP. An evaluation of the alternatives based upon the nine criteria was presented on pages 16 through 27 of the Proposed Plan. The comparative evaluation was presented in a tabular format due to the large number of alternatives considered (35) and the larger number of permutations available if components of alternatives are combined. A narrative comparison of every alternative and permutation using the nine criteria would be extremely lengthy, especially in light of the fact sheet format for Proposed Plans that EPA recommends. Community residents have commented that the Asarco Globe plan is already quite lengthy and complicated.
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> A more detailed evaluation of the alternatives based upon the nine criteria is presented in the Comparative Analysis of Alternatives section of the ROD. We again chose to include a tabular presentation of this evaluation due to the number of alternatives and available permutations. Because of the commentor's concerns, we have included a narrative discussion summarizing the comparative analysis using the NCP threshold and balancing criteria.
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> Discussions of the risk reductions associated with the selected remedial alternatives are presented in the Selected Remedy and Statutory Determination sections of the ROD. The Proposed Plan, on page 5, addresses how the preferred alternatives address the principal threats posed by the site. A more detailed discussion of why the preferred alternatives were selected, based upon the nine criteria, is presented in the Selected Remedy section of the ROD.

If the goal of no more than one additional cancer case per one million persons cannot be reached, a rationale should be provided, in terms of the nine evaluation criteria, explaining why it is not feasible to attain that level of protection.

The NCP establishes a risk range of 10^{-4} to 10^{-6} for risk management decisions, with the point of departure at 10^{-6}. EPA acknowledges that the point of departure of 10^{-6} does not presume that the final remedial action will or should attain such a risk level (55 Fed. Reg. at 8718, Preamble to the NCP). "EPA uses the general 10^{-4} to 10^{-6} risk range as a 'target range' within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager." (OSWER Directive 9355.0-30, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, April 22, 1991). A point within the acceptable risk range was selected based on the evaluation of background concentrations, uncertainties in risk estimates, and site-specific factors, including the effects of taking remedial actions to meet various risk levels within the risk range.

For the Globe site community soils remedy, the required action level for arsenic, 70 mg/kg, represents a protective cleanup level that falls within the acceptable risk range. Cleanup will be required to this level to ensure that all properties within the site area are cleaned to an acceptable risk level. However, the state recognizes that many residents may desire cleanup to a more protective level. The state has established that the anthropogenic upper limit of background for arsenic is 28 mg/kg. The state has included in the selected remedy an opportunity for residential properties that have contaminant levels above this background level to be cleaned up (equivalent risk level of $3x10^{-5}$). This cleanup of properties above this action level of 28 mg/kg arsenic provides the maximum practicable level of protection to the community. The community soils remedy meets the threshold criteria in that it is protective and will meet ARARs. While cleanup of larger areas provides more long-term effectiveness and permanence, it results in more short-term risk, implementability concerns, and cost. The selected remedy represents the best balance between long-term effectiveness and permanence; short-term effectiveness and risks incurred through remedial activities; reduction of toxicity, mobility and volume; implementability; and cost; while including consideration of community concerns by providing cleanup to all residential properties that are above the upper limit of background for arsenic.

For the air remedy, the selected remedy represents acceptable technical alternatives that are available to the state, while ensuring that the residual risk from the air remedy remains within protective levels. Use of HEPA filter technology is a potentially promising secondary control for point source emissions, however, a pilot test is necessary to determine the feasibility, implementability and cost of these filters in an industrial process setting. Therefore, the remedy includes the pilot testing of these controls, with subsequent evaluation after a one-year test period. The evaluation of the pilot test results, and the feasibility of installing HEPA filters, will be performed using the nine evaluation criteria described by CERCLA. The air remedy already provides for a residual risk that less than $1x10^{-4}$ and will be health protective for non-carcinogens (systemic toxicants); if the HEPA pilot test shows that HEPAs are feasible, the remedy will provide additional risk reductions.

For a discussion of the Ground Water and Surface Water Operable Unit, see the Introductory Remarks of this Responsiveness Summary.

Section 121 of CERCLA states that selected remedies must assure the protection of human health and the environment, and if a remedial action is chosen in which any hazardous substance, pollutant or contaminant remains on-site, the remedy shall require a level or standard of control for such substances which at least attains all applicable standards, requirements or limitations. Although a number of remedial technologies are included in the plan, in nearly all cases it is stated that the performance standards which the remedies must meet will be defined later. Without performance standards, it is impossible to assess whether the proposed remedies will protect public health or the environment or achieve the appropriate level or standard of control.

One of the modifying criteria for selection of a remedy is community acceptance, however, absent performance standards, the community similarly lacks a basis for ascertaining if the basic CERCLA criteria are being met. Therefore, we believe that the Proposed Plan should be modified to include all appropriate performance standards and risk information and then rereleased for public comment. At a minimum, if the Proposed Plan is not rereleased, the state should commit to extending the existing comment period until the "scope of work", which is to contain such details regarding the proposed plan, can be reviewed prior to the filing of the consent agreement with the court.

The selected remedy will assure the protection of human health and the environment, both on the Globe Plant property and in the surrounding community. For those remedial actions selected where hazardous substances remain on-site, the selected remedy requires that all applicable standards, requirements, or limitations must be met. The Proposed Plan, for each preferred alternative, identifies that ARARs would be met. This is further clarified in the Selected Remedy and Statutory Determinations Sections of the ROD, where a more detailed ARARs evaluation is presented. For those cases where applicable or relevant and appropriate standards exist, these performance standards will be met. This ROD includes detailed descriptions of the ARARs that apply to the selected remedy and of the performance standards that will be met by the selected remedy.

Due to public request, the initial public comment period on the Proposed Plan was extended an additional 30 days beyond the original 30 days. A 30 day public comment period will also be provided when the proposed Consent Decree with attached Statement of Work is lodged with the court. The state will notify interested parties when the proposed Consent Decree and attached Statement of Work is lodged with the court, so that they may comment further on the Proposed Plan, ROD, Consent Decree, and Statement of Work. Public comments at that time are submitted to CDH. The state will then review and respond to the comments and submit the comments and the state's responses to the federal court.

FORMER NEUTRALIZATION POND

1. The proposed remedy may not permanently ensure the protection of ground water from contamination. Specifically, since the neutralization pond material will not be stabilized, it will remain susceptible to leaching. The proposed remedy can only be effective as long as the cap, the slurry wall, and the ground water pumping system are effective. Ongoing ground water pumping will be required to keep the contaminated materials from coming into contact with the ground water table.

The drain system provided within the slurry wall will be designed to gravity drain from the slurry wall containment system to the ground water collection and treatment system. See the response to U.S. EPA comments for a more complete discussion of the Former Neutralization Pond remedy with regards to ARARs. The NCP recognizes that remedies may be selected that result in hazardous constituents remaining on-site, especially where large volumes of waste exist. For example, landfill remedies typically involve capping of waste that remains in place. These remedies less frequently include installation of slurry walls and drain systems. It is our understanding that the proposed remedy for the Lowry Landfill (the landfill contains characteristic hazardous wastes, as does the Former Neutralization Pond) includes capping, a partial slurry wall, a drain system, and institutional controls. The Lowry Landfill Proposed Plan does not specify whether a RCRA Subtitle C landfill cap will be constructed, or what performance standards will be required.

We continue to recommend the cap design we proposed in our comments on the feasibility study. That type of cap would be virtually maintenance-free.

While the cap design recommended in the Denver FS comments has merit due to low maintenance requirements, it does not appear to be consistent with RCRA guidance for cap design. The cap design of the selected remedy provides an additional low permeability geomembrane barrier in addition to the compacted clay barrier suggested in the FS comments. In addition, we believe that a properly designed and constructed cap will have very low maintenance requirements. Should the topsoil/vegetation require significant maintenance, we will give further consideration to the gravel/stone layer proposed in Denver's comments.

At a minimum, the plan must include aggressive monitoring of the operation and maintenance of the cap, slurry wall and pumping system, as well as an absolute financial guarantee from the state and Asarco. The financial responsibility portion of the agreement is not specific to the various remedies/contingencies. There must be a guarantee that proper maintenance and operations will continue whether Asarco closes the Plant, is no longer in business, or declares bankruptcy.

The comment is noted. We agree that aggressive monitoring is necessary for the entire remedy. Asarco and any successor will remain financially responsible for proper maintenance of the remedy and for contingencies as long as hazardous constituents remain on-site. Asarco and any successor will be required to continue to prove financial responsibility on an annual basis under criteria established by the state in 6 CCR 1007-3 Part 266 to demonstrate that it is financially able to meet these responsibilities, including all contingent remedies. If the state determines at any time that Asarco fails to meet this test, Asarco will be required to obtain a bond or similar financial instrument in an amount sufficient to meet its remaining commitments for the entire site.

2. Neither the plan nor the agreement includes numeric performance limits. This leaves unanswered the question of under what circumstances the contingent remedy would have to be implemented.

The plan and agreement describe monitoring requirements that will be used to determine if repairs or the contingency remedy are necessary (p.3, Principles of Agreement). In addition, the FS describes ARARs and performance standards for each alternative. The Principles of Agreement and FS are included in the public portion of the Administrative Record and are available for public review. In general, contaminant concentrations in the ground water will be required to reach MCLs (and non-zero MCLGs) through time. An inward gradient across the slurry wall and beneath the waste mass will be required. Ground water levels must be maintained below the bottom elevation of the waste materials. The waste materials will not be allowed to release significant contaminants that adversely effect ground water quality. The slurry wall and cap containment system must continually limit ground water volumes to be collected to below design limitations. If any of these criteria are exceeded, repairs will be necessary. If exceedances continue, the contingency remedy will be required.

B. GROUND WATER/SURFACE WATER (Alternatives 6a and 9a)

1. The terrace drainage system should be effective in preventing significant ground water contamination from leaving the Globe Plant site. However, in order to determine if the proposed remedy will protect public health and the environment, numeric performance standards for ground water quality must be included in the Proposed Plan. The specific standards associated with the Applicable Relevant and Appropriate Regulation (ARAR) must be stated. If there is not an ARAR standard appropriate we would conclude that CERCLA section 121 would govern. Section 121 states that a level or standard of control which at least attains Maximum Contaminant Level Goals (MCLG) established under the Safe Drinking Water Act shall be attained, where appropriate. The points of compliance to ensure the standard is met should be as near to the trench system as modeling indicates the actual contaminated ground water plume can be measured as it flows off-site.

Since MCLs exist for cadmium, arsenic, and zinc, MCLs will be established as the performance standard for the terrace drain system. Non-zero maximum contaminant level goals (MCLGs) are also included as ARARs for the selected remedy. For cadmium, arsenic, and zinc, the MCLGs are the same as the MCLs. In accordance with the NCP in the preamble to Section 300.430(e)(2)(i)(B), "MCLGs of zero are not appropriate for determining the actual cleanup levels to be attained under CERCLA because CERCLA does not require the complete elimination of risk..." 55 Fed. Reg. at 8752. The points of compliance will be located in the floodplain as close as possible to where the ground water plume flows off-site, considering access issues and physical restrictions (Washington Street).

2. The five-year review should ensure that the Industrial Drainage Ditch has not become recontaminated.

The comment is noted. The state agrees. Surface water and sediment quality sampling will be required in the long-term monitoring program to verify that the IDD has not become recontaminated.

3. A continuing mechanism should be provided to assure prevention of any future use of existing well water from drinking water or irrigation of edible crops until appropriate standards for the ground water have been attained. This is especially critical since the ground water may take 100 years to naturally attenuate.

The state shares the commentor's concern. As noted in the Introductory Remarks on ground water, the state has performed two water well use surveys in the Globe site area in 1987 and 1992 and found no drinking water use of wells in the contaminated plume area associated with the Globe site. Asarco, with oversight from the state, will perform annual well use surveys to assure that any existing wells within the contaminated plume area are not being used. To the best of our knowledge, water users within the contaminated plume area are currently connected to either City and County of Denver or Adams County municipal water systems. Moreover, current regulations promulgated by the State Engineer's Office prohibit installation of water wells within areas of contaminated ground water.

C. COMMUNITY SOILS (Alternative 5a)

1. The arsenic soil level of 70 mg/kg represents an excess cancer risk of 1.7 x 10 -4 (1.7 in 10,000) based upon a 30 year (age 1 to 31) exposure. This risk level is 70 percent greater than the EPA NCP acceptable risk level for the cleanup of Superfund sites. The arsenic concentration equal to the NCP maximum acceptable risk level (1x10 -4) is 40 mg/Kg, therefore we believe that 40 mg/Kg is the maximum allowable soil concentration that would be within the health-protective range for community soils.

The preferred alternative allows for a voluntary residential "buffer" area if levels exceed the "upper limit of background identified in the FS". The upper limit of background identified in the FS is 28 mg/Kg and should be identified in the Plan or the Scope of Work. The Plan should also document how the buffer area was delineated and the probability of finding concentrations above the action levels outside the buffer area. The action levels may be exceeded in parcels outside the remediation area defined by previous sampling. Therefore, all parcels east of I-25, south of East 60th Avenue, north of I-70, and west of the South Platte River should be tested.

We are unclear as to how the $1.7x10^{-4}$ excess cancer risk in Denver's comment was calculated. Using the methodologies described in the FS and the PHE, the arsenic soil level of 70 mg/kg represents an excess cancer risk of $6x10^{-5}$ (6 in 100,000) and the risk associated with the voluntary action level for arsenic, the upper limit of background as defined in the RI of 28 mg/kg, is $2x10^{-5}$ (2 in 100,000). Using current EPA RAGS guidance, the arsenic soil action level of 70 mg/kg represents an excess cancer risk of $8x10^{-5}$ (8 in 100,000) and the risk associated with the voluntary action level for arsenic is $3x10^{-5}$ (3 in 100,000).

The buffer area will include all residential areas within the 28 mg/kg arsenic isopleth. Residential areas are defined as those areas that are currently zoned as residential, and any areas that may be zoned for other use but are currently in residential use.

Additional property-specific sampling will be conducted to further delineate the edges of cleanup areas. While the sampling conducted in the RI/FS was sufficient to describe contaminant patterns, we will need to confirm the boundary of cleanup through additional sampling. Where properties appear to be near the "edge" of the cleanup area, additional sampling will be conducted until the edge of the cleanup area is more clearly defined. We plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels, including buffer action levels, in order to confirm this "edge".

2. The cadmium soil level of 73 mg/kg represents a Hazard Index of 0.93 based upon a bioavailability equal to that of food. If the bioavailability is equal to that of water, the Hazard Index is 1.87. A hazard index greater than 1 indicates that toxicity may result. Assuming a bioavailability equal to water, a soil concentration of 40 mg/Kg is necessary not to exceed a hazard index of 1.0. According to the Agency for Toxic Substance and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health & Human Services, the maximum soil concentration not resulting in adverse health effects is 10 ppm. In light of these differences we believe the cadmium cleanup standard should be reevaluated and a more restrictive cleanup level imposed, if the evaluation indicates an alternative level is necessary to protect human health.

We understand that the state has hired an independent consultant to evaluate the proposed cleanup level as well as the ATSDR's Environmental Media Evaluation Guide (EMEG) level of 10 ppm. The state has also sent several letters directly to ATSDR requesting clarification of the EMEG level and how that level applies in determining cleanup levels. The consultant's findings and any additional clarification from ATSDR are necessary to a complete review of the soil action levels. Therefore, we request that all documents provided to the state be formally released for public comment, to allow sufficient time for review, rather than only incorporating these documents into the state's response to public comment.

For a detailed discussion of cadmium soil issues, including the ATSDR EMEG issue, please see the Introductory Remarks of the Responsiveness Summary regarding this issue. We have been unable to duplicate Denver's calculations regarding the cadmium hazard index. The methodologies used to develop soil action levels are presented in the FS. We have reviewed these soil action levels using current EPA risk assessment guidance methodologies (RAGS), and the hazard index associated with soil ingestion at the cadmium action level of 73 mg/kg is 0.14. Our assumptions and methodologies regarding residual risk issues are presented in the Introductory Remarks, are available in the public portion of the Administrative Record, and have been distributed at public meetings.

Our consultant's review of the EMEG was provided to the community at a public meeting held on December 1, 1992. We received a health consultation from ATSDR; the health consultation was forwarded to individuals on our working group mailing list on January 13, 1993. These two documents are also available in the public portion of the Administrative Record. ATSDR, in its health

COMMENTS OF CITY AND COUNTY OF DENVER

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If the goal of no more than one additional cancer case per one million persons cannot be reached, a rationale should be provided, in terms of the nine evaluation criteria, explaining why it is not feasible to attain that level of protection.

The NCP establishes a risk range of 10^{-4} to 10^{-6} for risk management decisions, with the point of departure at 10^{-6}. EPA acknowledges that the point of departure of 10^{-6} does not presume that the final remedial action will or should attain such a risk level (55 Fed. Reg. at 8718, Preamble to the NCP). "EPA uses the general 10^{-4} to 10^{-6} risk range as a 'target range' within which the Agency strives to manage risks as part of a Superfund cleanup. Once a decision has been made to take an action, the Agency has expressed a preference for cleanups achieving the more protective end of the range (i.e., 10^{-6}), although waste management strategies achieving reductions in site risks anywhere within the risk range may be deemed acceptable by the EPA risk manager." (OSWER Directive 9355.0-30, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, April 22, 1991). A point within the acceptable risk range was selected based on the evaluation of background concentrations, uncertainties in risk estimates, and site-specific factors, including the effects of taking remedial actions to meet various risk levels within the risk range.

For the Globe site community soils remedy, the required action level for arsenic, 70 mg/kg, represents a protective cleanup level that falls within the acceptable risk range. Cleanup will be required to this level to ensure that all properties within the site area are cleaned to an acceptable risk level. However, the state recognizes that many residents may desire cleanup to a more protective level. The state has established that the anthropogenic upper limit of background for arsenic is 28 mg/kg. The state has included in the selected remedy an opportunity for residential properties that have contaminant levels above this background level to be cleaned up (equivalent risk level of $3x10^{-5}$). This cleanup of properties above this action level of 28 mg/kg arsenic provides the maximum practicable level of protection to the community. The community soils remedy meets the threshold criteria in that it is protective and will meet ARARs. While cleanup of larger areas provides more long-term effectiveness and permanence, it results in more short-term risk, implementability concerns, and cost. The selected remedy represents the best balance between long-term effectiveness and permanence; short-term effectiveness and risks incurred through remedial activities; reduction of toxicity, mobility and volume; implementability; and cost; while including consideration of community concerns by providing cleanup to all residential properties that are above the upper limit of background for arsenic.

For the air remedy, the selected remedy represents acceptable technical alternatives that are available to the state, while ensuring that the residual risk from the air remedy remains within protective levels. Use of HEPA filter technology is a potentially promising secondary control for point source emissions, however, a pilot test is necessary to determine the feasibility, implementability and cost of these filters in an industrial process setting. Therefore, the remedy includes the pilot testing of these controls, with subsequent evaluation after a one-year test period. The evaluation of the pilot test results, and the feasibility of installing HEPA filters, will be performed using the nine evaluation criteria described by CERCLA. The air remedy already provides for a residual risk that less than $1x10^{-4}$ and will be health protective for non-carcinogens (systemic toxicants); if the HEPA pilot test shows that HEPAs are feasible, the remedy will provide additional risk reductions.

For a discussion of the Ground Water and Surface Water Operable Unit, see the Introductory Remarks of this Responsiveness Summary.

Section 121 of CERCLA states that selected remedies must assure the protection of human health and the environment, and if a remedial action is chosen in which any hazardous substance, pollutant or contaminant remains on-site, the remedy shall require a level or standard of control for such substances which at least attains all applicable standards, requirements or limitations. Although a number of remedial technologies are included in the plan, in nearly all cases it is stated that the performance standards which the remedies must meet will be defined later. Without performance standards, it is impossible to assess whether the proposed remedies will protect public health or the environment or achieve the appropriate level or standard of control.

One of the modifying criteria for selection of a remedy is community acceptance, however, absent performance standards, the community similarly lacks a basis for ascertaining if the basic CERCLA criteria are being met. Therefore, we believe that the Proposed Plan should be modified to include all appropriate performance standards and risk information and then rereleased for public comment. At a minimum, if the Proposed Plan is not rereleased, the state should commit to extending the existing comment period until the "scope of work", which is to contain such details regarding the proposed plan, can be reviewed prior to the filing of the consent agreement with the court.

The selected remedy will assure the protection of human health and the environment, both on the Globe Plant property and in the surrounding community. For those remedial actions selected where hazardous substances remain on-site, the selected remedy requires that all applicable standards, requirements, or limitations must be met. The Proposed Plan, for each preferred alternative, identifies that ARARs would be met. This is further clarified in the Selected Remedy and Statutory Determinations Sections of the ROD, where a more detailed ARARs evaluation is presented. For those cases where applicable or relevant and appropriate standards exist, these performance standards will be met. This ROD includes detailed descriptions of the ARARs that apply to the selected remedy and of the performance standards that will be met by the selected remedy.

Due to public request, the initial public comment period on the Proposed Plan was extended an additional 30 days beyond the original 30 days. A 30 day public comment period will also be provided when the proposed Consent Decree with attached Statement of Work is lodged with the court. The state will notify interested parties when the proposed Consent Decree and attached Statement of Work is lodged with the court, so that they may comment further on the Proposed Plan, ROD, Consent Decree, and Statement of Work. Public comments at that time are submitted to CDH. The state will then review and respond to the comments and submit the comments and the state's responses to the federal court.

FORMER NEUTRALIZATION POND

1. The proposed remedy may not permanently ensure the protection of ground water from contamination. Specifically, since the neutralization pond material will not be stabilized, it will remain susceptible to leaching. The proposed remedy can only be effective as long as the cap, the slurry wall, and the ground water pumping system are effective. Ongoing ground water pumping will be required to keep the contaminated materials from coming into contact with the ground water table.

The drain system provided within the slurry wall will be designed to gravity drain from the slurry wall containment system to the ground water collection and treatment system. See the response to U.S. EPA comments for a more complete discussion of the Former Neutralization Pond remedy with regards to ARARs. The NCP recognizes that remedies may be selected that result in hazardous constituents remaining on-site, especially where large volumes of waste exist. For example, landfill remedies typically involve capping of waste that remains in place. These remedies less frequently include installation of slurry walls and drain systems. It is our understanding that the proposed remedy for the Lowry Landfill (the landfill contains characteristic hazardous wastes, as does the Former Neutralization Pond) includes capping, a partial slurry wall, a drain system, and institutional controls. The Lowry Landfill Proposed Plan does not specify whether a RCRA Subtitle C landfill cap will be constructed, or what performance standards will be required.

We continue to recommend the cap design we proposed in our comments on the feasibility study. That type of cap would be virtually maintenance-free.

While the cap design recommended in the Denver FS comments has merit due to low maintenance requirements, it does not appear to be consistent with RCRA guidance for cap design. The cap design of the selected remedy provides an additional low permeability geomembrane barrier in addition to the compacted clay barrier suggested in the FS comments. In addition, we believe that a properly designed and constructed cap will have very low maintenance requirements. Should the topsoil/vegetation require significant maintenance, we will give further consideration to the gravel/stone layer proposed in Denver's comments.

At a minimum, the plan must include aggressive monitoring of the operation and maintenance of the cap, slurry wall and pumping system, as well as an absolute financial guarantee from the state and Asarco. The financial responsibility portion of the agreement is not specific to the various remedies/contingencies. There must be a guarantee that proper maintenance and operations will continue whether Asarco closes the Plant, is no longer in business, or declares bankruptcy.

The comment is noted. We agree that aggressive monitoring is necessary for the entire remedy. Asarco and any successor will remain financially responsible for proper maintenance of the remedy and for contingencies as long as hazardous constituents remain on-site. Asarco and any successor will be required to continue to prove financial responsibility on an annual basis under criteria established by the state in 6 CCR 1007-3 Part 266 to demonstrate that it is financially able to meet these responsibilities, including all contingent remedies. If the state determines at any time that Asarco fails to meet this test, Asarco will be required to obtain a bond or similar financial instrument in an amount sufficient to meet its remaining commitments for the entire site.

2. Neither the plan nor the agreement includes numeric performance limits. This leaves unanswered the question of under what circumstances the contingent remedy would have to be implemented.

The plan and agreement describe monitoring requirements that will be used to determine if repairs or the contingency remedy are necessary (p.3, Principles of Agreement). In addition, the FS describes ARARs and performance standards for each alternative. The Principles of Agreement and FS are included in the public portion of the Administrative Record and are available for public review. In general, contaminant concentrations in the ground water will be required to reach MCLs (and non-zero MCLGs) through time. An inward gradient across the slurry wall and beneath the waste mass will be required. Ground water levels must be maintained below the bottom elevation of the waste materials. The waste materials will not be allowed to release significant contaminants that adversely effect ground water quality. The slurry wall and cap containment system must continually limit ground water volumes to be collected to below design limitations. If any of these criteria are exceeded, repairs will be necessary. If exceedances continue, the contingency remedy will be required.

B. GROUND WATER/SURFACE WATER (Alternatives 6a and 9a)

1. The terrace drainage system should be effective in preventing significant ground water contamination from leaving the Globe Plant site. However, in order to determine if the proposed remedy will protect public health and the environment, numeric performance standards for ground water quality must be included in the Proposed Plan. The specific standards associated with the Applicable Relevant and Appropriate Regulation (ARAR) must be stated. If there is not an ARAR standard appropriate we would conclude that CERCLA section 121 would govern. Section 121 states that a level or standard of control which at least attains Maximum Contaminant Level Goals (MCLG) established under the Safe Drinking Water Act shall be attained, where appropriate. The points of compliance to ensure the standard is met should be as near to the trench system as modeling indicates the actual contaminated ground water plume can be measured as it flows off-site.

> Since MCLs exist for cadmium, arsenic, and zinc, MCLs will be established as the performance standard for the terrace drain system. Non-zero maximum contaminant level goals (MCLGs) are also included as ARARs for the selected remedy. For cadmium, arsenic, and zinc, the MCLGs are the same as the MCLs. In accordance with the NCP in the preamble to Section 300.430(e)(2)(i)(B), "MCLGs of zero are not appropriate for determining the actual cleanup levels to be attained under CERCLA because CERCLA does not require the complete elimination of risk..." 55 Fed. Reg. at 8752. The points of compliance will be located in the floodplain as close as possible to where the ground water plume flows off-site, considering access issues and physical restrictions (Washington Street).

2. The five-year review should ensure that the Industrial Drainage Ditch has not become recontaminated.

> The comment is noted. The state agrees. Surface water and sediment quality sampling will be required in the long-term monitoring program to verify that the IDD has not become recontaminated.

3. A continuing mechanism should be provided to assure prevention of any future use of existing well water from drinking water or irrigation of edible crops until appropriate standards for the ground water have been attained. This is especially critical since the ground water may take 100 years to naturally attenuate.

> The state shares the commentor's concern. As noted in the Introductory Remarks on ground water, the state has performed two water well use surveys in the Globe site area in 1987 and 1992 and found no drinking water use of wells in the contaminated plume area associated with the Globe site. Asarco, with oversight

from the state, will perform annual well use surveys to assure that any existing wells within the contaminated plume area are not being used. To the best of our knowledge, water users within the contaminated plume area are currently connected to either City and County of Denver or Adams County municipal water systems. Moreover, current regulations promulgated by the State Engineer's Office prohibit installation of water wells within areas of contaminated ground water.

C. COMMUNITY SOILS (Alternative 5a)

1. The arsenic soil level of 70 mg/kg represents an excess cancer risk of 1.7 x 10 -4 (1.7 in 10,000) based upon a 30 year (age 1 to 31) exposure. This risk level is 70 percent greater than the EPA NCP acceptable risk level for the cleanup of Superfund sites. The arsenic concentration equal to the NCP maximum acceptable risk level (1x10 -4) is 40 mg/Kg, therefore we believe that 40 mg/Kg is the maximum allowable soil concentration that would be within the health-protective range for community soils.

The preferred alternative allows for a voluntary residential "buffer" area if levels exceed the "upper limit of background identified in the FS". The upper limit of background identified in the FS is 28 mg/Kg and should be identified in the Plan or the Scope of Work. The Plan should also document how the buffer area was delineated and the probability of finding concentrations above the action levels outside the buffer area. The action levels may be exceeded in parcels outside the remediation area defined by previous sampling. Therefore, all parcels east of I-25, south of East 60th Avenue, north of I-70, and west of the South Platte River should be tested.

We are unclear as to how the $1.7x10^{-4}$ excess cancer risk in Denver's comment was calculated. Using the methodologies described in the FS and the PHE, the arsenic soil level of 70 mg/kg represents an excess cancer risk of $6x10^{-5}$ (6 in 100,000) and the risk associated with the voluntary action level for arsenic, the upper limit of background as defined in the RI of 28 mg/kg, is $2x10^{-5}$ (2 in 100,000). Using current EPA RAGS guidance, the arsenic soil action level of 70 mg/kg represents an excess cancer risk of $8x10^{-5}$ (8 in 100,000) and the risk associated with the voluntary action level for arsenic is $3x10^{-5}$ (3 in 100,000).

The buffer area will include all residential areas within the 28 mg/kg arsenic isopleth. Residential areas are defined as those areas that are currently zoned as residential, and any areas that may be zoned for other use but are currently in residential use.

Additional property-specific sampling will be conducted to further delineate the edges of cleanup areas. While the sampling conducted in the RI/FS was sufficient to describe contaminant patterns, we will need to confirm the boundary of cleanup through additional sampling. Where properties appear to be near the "edge" of the cleanup area, additional sampling will be conducted until the edge of the cleanup area is more clearly defined. We plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels, including buffer action levels, in order to confirm this "edge".

2. The cadmium soil level of 73 mg/kg represents a Hazard Index of 0.93 based upon a bioavailability equal to that of food. If the bioavailability is equal to that of water, the Hazard Index is 1.87. A hazard index greater than 1 indicates that toxicity may result. Assuming a bioavailability equal to water, a soil concentration of 40 mg/Kg is necessary not to exceed a hazard index of 1.0. According to the Agency for Toxic Substance and Disease Registry (ATSDR), Public Health Service, U.S. Department of Health & Human Services, the maximum soil concentration not resulting in adverse health effects is 10 ppm. In light of these differences we believe the cadmium cleanup standard should be reevaluated and a more restrictive cleanup level imposed, if the evaluation indicates an alternative level is necessary to protect human health.

We understand that the state has hired an independent consultant to evaluate the proposed cleanup level as well as the ATSDR's Environmental Media Evaluation Guide (EMEG) level of 10 ppm. The state has also sent several letters directly to ATSDR requesting clarification of the EMEG level and how that level applies in determining cleanup levels. The consultant's findings and any additional clarification from ATSDR are necessary to a complete review of the soil action levels. Therefore, we request that all documents provided to the state be formally released for public comment, to allow sufficient time for review, rather than only incorporating these documents into the state's response to public comment.

For a detailed discussion of cadmium soil issues, including the ATSDR EMEG issue, please see the Introductory Remarks of the Responsiveness Summary regarding this issue. We have been unable to duplicate Denver's calculations regarding the cadmium hazard index. The methodologies used to develop soil action levels are presented in the FS. We have reviewed these soil action levels using current EPA risk assessment guidance methodologies (RAGS), and the hazard index associated with soil ingestion at the cadmium action level of 73 mg/kg is 0.14. Our assumptions and methodologies regarding residual risk issues are presented in the Introductory Remarks, are available in the public portion of the Administrative Record, and have been distributed at public meetings.

Our consultant's review of the EMEG was provided to the community at a public meeting held on December 1, 1992. We received a health consultation from ATSDR; the health consultation was forwarded to individuals on our working group mailing list on January 13, 1993. These two documents are also available in the public portion of the Administrative Record. ATSDR, in its health consultation, concluded that the cadmium action level of 73 mg/kg is protective but cautioned that garden vegetable exposures and risk to pica children should be considered. These two issues are discussed in detail in the Introductory Remarks section of this Responsiveness Summary. A public meeting with an ATSDR representative available to answer questions was held on February 10, 1993. A memo summarizing his comments, questions asked, and responses given has been included in the public portion of the Administrative Record.

3. The EPA guidance is that not more than 5 percent of the childhood population should be predicted to have blood lead concentrations more that 10 ug/dl. The EPA Integrated Uptake Biokinetic Model (IUBK), version 5, was used by Slosky & Company to evaluate lead exposures. Assumptions used in this model were: (1) drinking water lead = 9.5 ppm (the average of City-wide testing by the Denver Water Department; (2) dust lead = 462 ppm, as Slosky & Company measure in Stapleton Homes; and (3) ambient air lead = 0.79 ug/m3, as modeled by Slosky & Company. Using these assumptions, the IUBK model predicts that 7.3 percent of the children will have blood lead values greater than 10 ug/dl with a soil lead value of 500 ppm (the proposed community soil action level.

The model is sensitive to the amount of lead in the dust. Lead in the air is most likely contributing significantly to lead in the dust. Therefore, lead air emissions should be evaluated at the time additional stack testing is conducted to determine if the air emission controls will reduce lead emissions as well as cadmium emissions. The lead slag pile should also be capped or covered. If these additional areas are addressed then the proposed lead action level is likely to be protective. However, if future evaluation by the state shows that the dust levels will continue to represent an unacceptable risk, then additional emission controls should be implemented.

The site action level for lead of 500 mg/kg is based upon EPA's OSWER Directive #9355.4-02, dated September 7, 1989. In an August 29, 1991 memorandum, EPA discusses use of the uptake-biokinetic (UBK) model as a risk management decision-making aid when setting soil lead cleanup levels in residential areas. If, prior to completion of a remedial action for community soils, EPA guidance is changed to formally advise use of UBK to establish action levels for lead in soils for CERCLA remedies, this guidance will be evaluated to determine its appropriateness for this site. If determined appropriate, Asarco will either expand the area of remediation into adjacent areas not previously remediated that have a lead level between the upper limit of background (413 mg/kg) and 500 mg/kg, or obtain the samples necessary to correctly model impacts to individuals under the UBK model. This sampling will include house dust and ambient air sampling. Since this model calculates blood lead impacts, additional remediation or sampling would be limited to residential areas with soil lead levels between 413 mg/kg and 500 mg/kg. The state may at any time use

UBK to evaluate remedy protectiveness under the reopener provisions. The lead slag pile will be covered as part of the remedy.

Regarding the modelled lead value of 0.79 ug/m^3, the Slosky analysis may not represent the current situation. In the fall of 1989, Asarco added an additional baghouse to its litharge (lead oxide) department. Modelling presented in the FS predicted that the monthly ambient lead concentration was 0.308 ug/m^3 prior to the baghouse addition, and 0.147 ug/m^3 after the new baghouse was added. These values can be compared to the state standard 1.5 ug/m^3 as a monthly average. Ambient air monitoring data collected at the four Asarco stations indicates that lead levels in neighborhood air decreased significantly, after the baghouse addition.

Denver inquired as to whether the additional cadmium air pollution controls will reduce lead emissions. Although the majority of lead emissions come from the litharge department, lead is a trace impurity in the cadmium circuit. Thus, increased controls on the cadmium process may slightly reduce lead emissions.

4. There is no information on the testing program to be used to determine which parcels will be remediated. It is not clear if parcel-by-parcel testing will be conducted to determine which properties exceed the action levels and therefore, will be remediated. Parcel-by-parcel testing is required to protect human health because of the non-uniform dispersion of contaminants from the Globe Plant.

The comment is noted. Property-by-property testing will be conducted to determine which properties will be remediated. Where properties appear to be near the "edge" of the cleanup area, additional sampling will be conducted until the edge of the cleanup area is more clearly defined. We plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels in order to confirm this "edge".

5. The depth of testing is also not specified. If the testing is limited to the top six inches of soil, contaminants exceeding the action levels will remain in place below six inches. Analysis of the soil data collected by the State of Colorado/Asarco show that (with an arsenic action level of 70 ppm) 25 percent of the sampling locations meet the action level in the top six inches, but exceed the action level below 6 inches. Therefore, in order to ensure that all areas of contamination above action levels are remediated, the testing must be at least to the depth of potential excavation, a maximum depth of 18 inches.

Sampling will be conducted at the 0-2 inch interval and the 0-6 inch interval. If action levels are exceeded in either sampling interval, the property will be remediated. The community soils remedy limits exposure through removal and covering, reducing risks to acceptable levels. The risks associated with exposure to community soils are estimated based upon long-term exposures (70 years). It is extremely unlikely that long-term exposures to soils that have been covered with 12 inches of clean soil could take place.

6. The state must also undertake an extensive public education process to ensure that all affected residents and businesses fully understand their options and the consequences of their decisions. Remedial actions of capping or exposure controls are not permanent. The contaminants will remain to potentially cause future exposures if an area erodes or is excavated for construction. If soil removal is limited to 12 inches, significant levels of contamination will remain. Based upon the soil data collected by the State of Colorado/Asarco, 65 percent of the sampling locations exceed action levels for at least one of the metals below 12 inches (arsenic action level of 28 ppm). With an arsenic action level of 70, 53 percent of location exceed at least one action level below 12 inches. Developing new vegetable gardens may be a health hazard because significant contamination will remain more that 12 inches below the ground surface.

The state agrees with the commentor regarding the importance of providing extensive public education to help residents understand their options and the consequences of their decisions. We also intend that educational efforts will be translated into Spanish. We will be meeting with community residents both individually and through larger group meetings to explain health risks and remediation activities throughout the cleanup period. We will also be distributing English/Spanish fact sheets that explain remedy components.

The community soils remedy effectively limits exposure through a combination of removal with replacement of soils and/or covering, therefore reducing risks to acceptable levels. "CERCLA does not require the complete elimination of risk or of all known or anticipated effects; i.e., remedies under CERCLA are not required to entirely eliminate potential exposure..." (55 Fed. Reg. at 8752). The risks associated with exposure to community soils are estimated based upon long-term exposure (70 years), rather than the short-term exposures that could potentially occur during construction excavation.

In addition, during community soils remedial activities, any resident wishing to plant vegetable gardens in new areas of his/her yard may request soil sample analysis at a depth of 12 inches. Soil sampling and analysis, or additional soil will be provided. If the sample exceeds action levels, clean soil will be provided such that a total depth of 18 inches of clean soil is in place for the new garden. After community soils remediation has been completed, CDH will evaluate whether to continue this program.

7. Since parcel-by-parcel cleanup will involve numerous property owners, with differing concerns and levels of knowledge with regard to the implications of the contamination on their property, who will decide which remedial measure to implement and what criteria will be used to make the decision? We believe that the most permanent remedy should be strongly recommended to all property owners.

A model cleanup plan has been developed that includes the most permanent remedy components, with provision for selection of alternate components if the property owner chooses. This model plan is described in the Selected Remedy section of the ROD. Cleanup plans for each parcel will be developed that include the appropriate components of the model cleanup plan. These parcel-specific plans will be presented and described to the property owner. The property owner will then have the opportunity to select other options for cleanup if they desire. Any variations must be approved by the property owner. CDH will be available to describe the components of the model plan, and to answer questions. Public meetings will be held to explain factors to consider when evaluating cleanup plans.

8. The Plan states that remediation in the area exceeding the arsenic action levels also would remediate areas where lead exceeds background concentrations (413 ppm). An analysis of the soil data collected by the State of Colorado/Asarco shows that a cleanup of locations exceeding 70 ppm arsenic would leave in place 17 percent of the locations with lead exceeding 413 ppm would remain if the arsenic action level is 28 ppm. Please explain the inconsistency between the proposed plan and these findings as well as the additional steps that will be take to meet the lead remediation goal stated in the plan.

The Proposed Plan states that "It is likely that soil cleanup in the areas described by the arsenic action levels would result in cleanup of areas where lead exceeds the upper limit of background concentrations." (emphasis added) As noted by Denver, there is a small number of properties where lead concentrations are between 413 mg/kg and 500 mg/kg that are outside the arsenic action level areas. However, these properties are primarily located in commercial areas and do not present exposures that would justify lower action levels. The action level of 500 mg/kg that is provided in the commercial areas was established by EPA for residential exposure scenarios and is conservative for commercial land usage.

In addition, as described in response to comment #3 above, if determined appropriate through use of the UBK model, Asarco will either expand the area of remediation into adjacent areas not previously remediated that have a lead level between the upper limit of background (413 mg/kg) and 500 mg/kg, or obtain the samples necessary to correctly model impacts to individuals under the UBK model. The state may at any time use UBK to evaluate remedy protectiveness under the reopener provisions.

D. PLANT SITE (Alternative 5a and the JACA Report)

1. Air dispersion modeling has been conducted by JACA for the State of Colorado. The cadmium emission limit of 162 kg/year has not been modeled. However, by factoring Scenario 2 of the JACA report, an ambient concentration of 0.05955 ug/m3 of cadmium is estimated. This translates into an excess cancer risk of 1.1x10 -4, slightly higher than the NCP maximum acceptable risk. This risk should be identified in the Plan. The hazard index associated with this emission level should also be included. Will a hazard index of 1.0 or less be achieved?

The cadmium emissions limitation contained in the Proposed Plan is approximately equivalent to a $1x10^{-4}$ excess cancer risk, essentially the same value as $1.1x10^{-4}$ as Denver has calculated and the 8.6×10^{-5} excess cancer risk level estimated by our calculations.

The state believes that the HEPA filter technology is a promising technology and that using this technology, emission reductions to lower the residual risk level may be feasible. The Air Engineering Design Study estimated that reductions to a $1x10^{-5}$ excess cancer risk may be possible through use of HEPA filters.

There is currently no EPA reference concentration (RfC) for cadmium available to evaluate the hazard index associated with cadmium emissions. However, CDH understands that EPA is currently in the process of developing a RfC for cadmium inhalation such that a hazard index can be calculated. The evaluation of the pilot test will include an evaluation of remedy protectiveness, including an evaluation of the hazard index associated with cadmium emissions, if a RfC is available at that time. If a hazard index can be calculated, a hazard index of 1.0 or less will be achieved for site-wide exposures.

2. The JACA report did not evaluate the hazard index associated with the emission data or control technologies that were in the report. We believe that the state must reevaluate and provide the hazard index for the various exposure scenarios to ensure that the CERCLA criteria are met.

In the absence of a cadmium RfC, the potential for systemic effects due to cadmium inhalation can not be quantitatively evaluated using EPA methodologies. The evaluation of the HEPA pilot test will include an evaluation of the hazard index associated with cadmium emissions, if an RfC is available at that time. See the response to item 1, above.

3. The fugitive emissions, as discussed in the JACA report, need further evaluation. Specifically, high wind conditions and direction of wind should be correlated (i.e.

Chinook winds and winter storms) and a review of geographically proximate meteorological data should be used to provide an historical record. Once suitable climatological data is established, an event model should be run to determine pollutant distribution from the Globe site and these concentrations should be added to the ISCLT model runs to determine overall risk. All of the fugitive emissions, including the emissions from the dusty buildings, should be included in the model evaluation. Since the cadmium emission limit is only for "stack" emissions, if the fugitive emissions and subsequent impacts were underpredicted then the sum of the fugitive and stack emissions will need to be reduced further to ensure that the 1x10 -4 to 1x10 -6 risk range is met.

The fugitive emission model assumptions are not always conservative. For instance, the use of scaler factors for the wind speed categories removed the lower wind speed contributions from the fugitive emissions. At the Globe site, with buildings and other urban influences, the air turbulence would be expected to be higher and would therefore maintain the large particles in the air stream for a longer period of time and would increase the distance of transport and impact. The modeling approach used directly contradicts these assumptions and makes the modeling less conservative. The combined building wake effect of the BreezeWake program was not selected, again resulting in a less conservative approach. The question of silt content of the road should be resolved through testing.

Why does the equation for calculating the emissions for wind erosion not include either a wind speed or turbulence factor?

The Air Engineering Design Study states that a previous emission inventory reveals that the majority of Plant emissions were generated from point sources. Since this appears to be the case, using ISCLT-2 is appropriate in modeling impacts from Asarco. The CDH Air Pollution Control Division is not aware of an "event model" that would be appropriate for use in helping determine pollutant concentrations at this facility.

The summary of ISCLT-2 model inputs (Table 9-1, page 9-5 of the Air Engineering Design Study) indicates that building wake effects were included in the model simulations. Also, according to this table, pollutant emissions were varied by wind speed for fugitive emissions, thus accounting for variable meteorological conditions from these source categories.

The wind erosion equation does account for wind speed and turbulence factors in the soil erodibility term (called *I* in the wind erosion equation). This term represents the erosion from an open area where the climate is highly conducive to wind erosion (that is high wind speeds and little precipitation).

It should be noted that little meteorological data from earlier periods is available. Attempts to correlate contemporaneous data collected at the Globe Plant, Stapleton Airport, and the state's Welby site (78th and Steele Streets), showed poor relationships between the three locations. Thus, the state does not believe that data collected in other locations would fully represent the Globe site.

Denver suggests that emissions from dusty buildings be included in model analyses. CDH agrees that this would provide a more complete analysis of air impacts. However, we know of no way to quantify the levels of fugitive emissions that may be leaving through open doors or windows. Therefore, the state has decided to address this problem through requirements for fugitive emission control plans and Plant housekeeping plans. In the past, a state inspector has observed fugitive emissions leaving the door of the leaching building. It is believed that the improved hopper and baghouse planned for the leaching department will capture these emissions. It should also be remembered that the federal Occupational Health and Safety Administration (OSHA), with its goal of reducing exposures to Plant employees working inside buildings, has required additional controls on many Plant processes. These include improved hoods on equipment in the Premelt building, and on the four retort furnaces.

4. No criteria are provided for making the decision regarding whether or not to implement the HEPA filters. How will the trade-off between the cost of HEPA filters and their public health benefits be analyzed? How will the actual operation and maintenance costs of the filters, as well as their efficiency, be monitored and validated during the pilot study to ensure these data are accurate?

The evaluation of the HEPA filter pilot test will be based upon the CERCLA nine criteria, including the threshold criteria of overall protection of human health and the environment and compliance with ARARs. The protectiveness determination will include an evaluation of residual risk and potential for systemic effects on a site-wide basis. Controls or emissions limitations will be required such that the overall site remedy is protective for both carcinogens and non-carcinogens (systemic toxicants).

Attachment 1 of the First Amendment to the Agreement in Principle/ Principles of Agreement describes the methodologies to be used in conducting the HEPA filter pilot test; these methodologies include the right of the state to independently verify HEPA cost data and efficiencies. In addition, the state will be present during the installation of the pilot HEPA, performance of stack tests, maintenance of the system, and filter change-outs. The First Amendment to the Agreement in Principle/ Principles of Agreement, as well as the Agreement in Principle, is available in the public portion of the Administrative Record and has been made available to the City and County of Denver.

5. Why is an emission limit for arsenic not included? A change in raw material composition can occur. Therefore, to ensure that the risk from arsenic exposure will not increase, an emission cap is essential. Again, the risk should be identified in the Plan. Also, the Public Health Evaluation (PHE) shows significant health risks from arsenic. In the PHE, arsenic comprised 45 percent of the total risk from air emissions. The JACA study shows much lower ambient levels of arsenic than previous studies. This discrepancy should be explained.

Arsenic is an impurity in the cadmium feedstock, and therefore arsenic emissions are reduced proportionately with any reductions in cadmium emissions. CDH estimates that the residual risk due to arsenic emissions from current operations is approximately $2x10^{-6}$. When aggregated with the risk due to cadmium emissions, the total risk due to air emissions is approximately $8.62x10^{-5}$. Due to the uncertainties involved in risk assessment, this value would be rounded to $9x10^{-5}$ excess cancer risk.

The maximum risk level due to arsenic in air emissions from the PHE was based upon the highest value recorded at the air monitoring stations. The average risk level due to arsenic emissions from the PHE reflects the fact that monitored air values were below the detection limit for the majority of monitoring periods. One/half of the detection value was used in calculating an annual average to evaluate arsenic risk. The Air Engineering Design Study risk estimate is based upon a modelled annual average. The level associated with the emissions limitation would be well below a detectable level in ambient air.

6. The Plan should ensure that before the thallium, indium, or cadmium sulfide processes are operated, adequate evaluation and controls are implemented to limit emissions to an excess cancer risk of 1 x 10 -6 or less, and hazard indices of 1.0 or less. Since this process is not currently in operation the most restrictive health standard should be met prior to allowing start-up.

The Proposed Plan states that, should these processes become operational, their contribution to Plant emissions would be evaluated and the controls available to minimize these emissions would be analyzed. Appropriate protectiveness goals will be evaluated at that time. The Colorado Air Quality Control Commission also has independent authority to determine appropriate controls for emissions from these processes. The goal of the CDH Air Pollution Control Division is a $1x10^{-6}$ excess cancer risk. The Colorado Clean Air Act does not specify an acceptable excess risk level.

7. The Plan allows highly-contaminated soils to remain on the Globe Plant site. The soils could cause further contamination through wind-blown dispersion and/or leaching by surface water. Without performance standards, the safety of this remedy cannot be

determined. This remedy is only effective as long as Asarco maintains the highly contaminated soils in a non-erosional state. How is Asarco going to ensure that the highly contaminated soils do not become exposed 100 years from now? Twelve inches of cover is not a fail-safe remedy. Without detailed plans for the perpetual control of the soils on-site and given the very real possibility of fugitive emissions recontaminating the community soils, the only health protective standard would be equivalent to the final community soil action levels.

As stated in the Proposed Plan and the Agreement in Principle, the Plant site soils remedy must not cause surface water contamination, ground water contamination, or wind-blown dust. Performance standards for percent vegetation cover will be established. Testing will be required to establish contaminant concentrations in Plant site soils that will not contribute to ground water or surface water contamination. Soils that are contaminated above these levels will not be placed on the Plant site. Soil areas above any soil action levels, including community soil action levels, will be vegetated to prevent wind-blown soil movement. Additional topsoil, tilling, or soil additives will be applied to any areas that will not support vegetation such that vegetative cover is provided. Operational areas not conducive to vegetation such as roads will be paved.

The First Amendment to the Agreement in Principle/Principles of Agreement contains specific details regarding land use restrictions. Asarco will be required to file a written instrument containing a land use restriction with the appropriate entities within 30 days after entry of the Consent Decree. This recorded instrument shall be binding on Asarco, its successors and assigns, and will include provisions for access and enforcement by the and reasonable prior notification to the state of any change in land use that may result in the remedy no longer being protective of human health and the environment. If the state determines that such a change in land use would cause the remedy to no longer be protective of human health and the environment, further land use restrictions may be imposed and/or additional remedial actions may be required by the state.

8. Without performance standards for ground water quality, it is not possible to determine whether the sedimentation pond remedy protects human health. Performance standards are also not provided for determining if the contingent remedy is to be implemented. Would the contingent remedy involve disposal at an on-site or off-site facility?

The performance standards for ground water quality are the pertinent MCLs and non-zero MCLGs. ARARs for the remedial alternatives were described in the Feasibility Study. The SDWA MCLs were included as ARARs for each ground water remedy and will be the performance standards. The stabilized sediments will be disposed of in an on-site disposal facility, unless off-site disposal proves to be cost-effective. Any on-site disposal will meet all appropriate regulatory requirements.

9. The Plan should include surface and ground water quality performance standards on-site to evaluate the effectiveness of sealing the floors and drains.

As stated above, the performance standards for ground water are SDWA MCLs and non-zero MCLGs. The performance standards for surface water are Colorado Clean Water Act water quality criteria.

10. There should be a provision in the Plan which requires that a new risk assessment be conducted if there are any process changes or additions from those identified in the JACA study.

CERCLA is not intended to replace other regulatory authorities that apply to future air pollution sources that are not currently present on the Plant site. Future process changes or additional sources can be controlled through the appropriate regulatory authorities, such as the Air Quality Control Commission.

11. Rather than reiterating here our preliminary comments submitted September 24, 1992, on the JACA report, we request that they be considered a part of our formal comments on the Plan. One issue, however, that we believe deserves additional attention in these comments is the meteorological data used in the modeling. We believe that an evaluation to ensure that worst-case conditions are being used in the model runs is imperative. We suggest that the state evaluate the information obtained on-site against historical data from the Stapleton site to at least estimate if the data used could reasonably be considered worst-case.

We have already responded to Denver's previous comments on the Air Engineering Design Study and are incorporating them and our responses by reference as part of this Responsiveness Summary. Denver's previous comments, and our responses, are part of the public portion of the Administrative Record.

With regard to the meteorological data used in the modelling, the state does not feel that a comparison between the 1990 and 1991 on-site data, and the Stapleton site, would be useful. As noted in our response to Denver's Plant site Comment D3, above, data collected at Asarco does not compare well to that collected at the Stapleton Airport. We believe that the reason is the difference in orientation with respect to the Platte River drainage. Meteorological monitoring is ongoing at the Asarco site, and will be continued. An additional full year of data (1992), will be available soon. Denver or other commentors may request the data, and conduct their own analyses, if desired.

E. MEDICAL MONITORING PLAN (Attachment 2)

1. The number of people who will be needed to conduct community education and outreach should be estimated based upon the scope of the plan. It is critical that community members be hired and that they have bilingual communication skills. The education process must be explicitly defined in the scope of work and should include an aggressive program to communicate both the remediation process and the importance of the medical monitoring. The community education staff need to aggressively work with the community members to ensure that people are being tested at the appropriate times and receiving follow-up testing. These features should also be included in the scope or work.

The comment is noted. We intend to inform the community of any medical monitoring staff positions, and, to the extent allowed by state hiring practices and procurement requirements, we will carefully consider any community members who apply. We recognize the necessity to provide staff with bilingual communication skills, and will value highly bilingualism and familiarity with the community in the staff selection process. The education process will be defined in the Statement of Work and will include a program to communicate both the remediation process and the importance of medical monitoring.

2. The medical monitoring plan should explicitly recognize the need for secondary tests pursuant to abnormal results, and should specify the provision of funding for such tests.

The medical monitoring portion of the Statement of Work will explicitly recognize the need for follow-up testing for any resident that has elevated levels of metals. Asarco will be responsible for funding follow-up testing.

3. Who will be responsible for treatment costs incurred at the Globeville Health clinic or at other medical facilities?

Asarco will be responsible for all costs associated with the medical monitoring program.

4. We believe that there should be provisions for on-going, long-term monitoring (assessment/evaluation) beyond the completion of remediation activities.

The medical monitoring program offered will establish baseline measurements of arsenic, cadmium, and lead through biological testing for everyone in the community who wishes to participate in the program. If monitoring performed during the remedial actions indicates that remediation is not protective, i.e., biological indicators increase, then the reopener provisions of the Consent Decree will be used. If monitoring does not indicate a problem, it is not necessary to continue biological monitoring beyond the completion of remediation activities. Any potential increases in exposure over time would be detected in on-going environmental monitoring programs.

The medical monitoring program is not a substitute for environmental sampling. Environmental sampling will be conducted throughout the remedial activities and after remedial activities are completed. If environmental sampling indicates the the same or lower levels of the metals of concern as those that are found at the completion of remedial activities, there is no reason to believe that levels found through continued biological testing would increase.

F. OTHER ISSUES

1. Denver thinks it is essential that future use of property owned by third-party land owners not be restricted. The proposed cleanup plan for community soils would, in many cases, leave metals-contaminated soils on the property of innocent land owners. Therefore, Denver asks that the state provide specific release of liability to those property owners for any potential future encounters with, or disposition of contaminated soil either during or after the cleanup. This release, or covenant not to sue, must run with the land to ensure that the property can be freely transferred and to ensure that the financial community will provide loans for these properties.

The state does not intend to sue any property owner in the Globe area for contamination that is associated with the Asarco Globe Plant. The suggestion regarding specific release of liability to individual property owners has merit and will be further considered by the state, along with EPA guidance on "innocent landowner" criteria of CERCLA.

2. It is also necessary that an adequate plan for institutional controls be provided to assure that soils above action levels which are left in place are not disturbed in the future, or if they are disturbed, by construction or other activities, that adequate controls and disposal of contaminated soils will be implemented. Natural resource damages should be put in trust to be used for future testing, disposal, and other contamination-related costs for future construction or development on residential, commercial, industrial or public property.

The state does not believe that institutional controls are necessary for community properties because the remedy will be protective. For the Plant site property, institutional controls will be provided to ensure that land use remains protective. The state will work closely with the community and the local governments to establish a plan for use of natural resource damages that is of benefit to the community.

We found it difficult to fully comment on many aspects of the Proposed Plan due to the absence of performance standards, risk information and rationales for the preferred alternatives. We would welcome, and once again request, the opportunity to augment these comments in more detail once your office has developed the appropriate standards and provided the detailed information necessary to complete a review.

Anyone can provide additional comments on the RI/FS process, the Proposed Plan, the ROD, and the Consent Decree/Statement of Work after lodging of the proposed Consent Decree with the federal court. Such comments should be submitted to CDH. The public will be notified when the proposed Consent Decree is lodged with the court.

COMMENTS OF DENVER HOUSING AUTHORITY, SUBMITTED BY KEVIN MARCHMAN

1. The study of the Asarco Globe Plant site has consumed over a decade. The delay had been costly to DHA and the neighborhood. Consequently, it is critical to DHA that all phases of the proposed cleanup be accomplished in as expeditious a manner as possible. Yet, the Proposed Plan provides no assurance that the clean-up process will be implemented and completed promptly. The Proposed Plan contains no schedule delineating the time frame for implementing the various remedies. A schedule should be included in any final plan.

If there is more delay, DHA and other residents may need to perform sampling and even cleanup work on their own, then sue to recover their costs. This can only complicate and render the overall process more expensive and burdensome for all parties involved.

Asarco could mitigate problems stemming from delay by allowing property owners to establish sampling plans of their own property which can be implemented on an expedited basis. Such plans could be developed in conjunction with and approved by Asarco and the State of Colorado. The costs would be borne by Asarco. Through this avenue, property owners left hanging by the economic uncertainty surrounding their property could develop sampling plans tailored to their own property to be performed on an expedited basis. In turn, this could potentially streamline the actual cleanup phase by reducing the overall area included within final cleanup boundaries.

Pursuing cleanup of a contaminated site through the CERCLA process is often time-consuming. However, often CERCLA is the best or only way to achieve cleanup of many different aspects of a contaminated site. The state is committed to ensuring that the cleanup of the Asarco Globe site is expedited to the extent possible.

The Statement of Work will contain schedules for planning, design, and remedial actions. For example, sampling for the community soils remedy is scheduled to take place in late summer and fall of 1993, followed by remedial design and obtaining access for construction in the winter of 1993-1994, with soil removal beginning in 1994. Order of remediation will progress from required residential areas, to voluntary residential areas, to commercial properties.

Because this is a large and complex site, the state cannot commit to providing detailed review and approval of many different sampling plans from individual property owners. Providing this review could cause significant delays in other portions of the site cleanup. The state will hold Asarco responsible for developing a sampling plan and obtaining sample data for the entire site that is of sufficient quality to make remediation decisions. Should individual property owners, including DHA, choose to work out agreements with Asarco to expedite sampling, the state will not interfere as long as complete data of sufficient quality is obtained.

2. To minimize uncertainty surrounding the status of properties, the state should provide a letter to property owners after cleanup is performed certifying their property as "clean" under the standards developed in the final plan. In the interim, the state should provide an intermediate letter to such landowners, explaining the current status of their property to the cleanup process (e.g. describing results of prior testing, plans for further sampling, etc.).

The comment is noted. Once properties have been remedied, the state intends to provide land owners with a letter establishing that their property has been cleaned. We also plan to make available to property owners construction documentation results, including the results of testing and the extent of cleanup performed. During remedial activities, the state will work closely with property owners to inform them of the status of cleanup plans, plans for further sampling, and plans for remedial action. We will also be available to work with area lenders to clarify cleanup related issues.

3. It is not clear from figure 5, labeled "Community Soils Cleanup," whether DHA's entire property is included in the area slated for additional sampling and possible cleanup. DHA has been informed that the DHA tract is included in soil sampling plans. The figure and accompanying text must be amended to make this absolutely clear. While initial data indicates that soil levels of cadmium, arsenic and lead on the DHA property may be below action levels contained in the proposed Plan, further confirmatory sampling is warranted.

Figure 5 of the Proposed Plan is based upon the soil sampling conducted during the RI/FS and is not intended to describe the exact boundaries slated for cleanup. Rather, it is intended to show general contaminant patterns and the general area where additional sampling will be necessary to confirm whether remediation is necessary. Decisions regarding whether properties will require cleanup should not be made based upon Figure 5; these decisions should be made based upon sampling conducted on the individual property. Additional property-specific sampling will be conducted to further delineate the edges of cleanup areas. While the sampling conducted in the RI/FS was sufficient to describe contaminant patterns, we will need to confirm the boundary of cleanup through additional sampling. Where properties appear to be near the "edge" of the cleanup area, additional sampling will be conducted until the edge of the cleanup area is more clearly defined. We plan to sample the width of a standard city block, 660 feet, beyond any area found to be contaminated above action levels in order to confirm this "edge".

More detailed soil contaminant maps can be found in the RI/FS reports. A review of these maps shows that the DHA property will require additional sampling to define the edge of the cleanup area.

4. The Community Soils section of the Proposed Plan does not define what constitutes "residential areas." The property owned by DHA is zoned for residential use; it should be clarified that DHA's property constitutes a residential area for purposes of the proposed community soils remedy. In turn, it should also be clarified that DHA would have the option, if appropriate, to request "buffer cleanup" of arsenic to background, as provided in the Proposed Plan at p. 11.

Residential areas are defined as those areas that are currently zoned as residential, and any areas that may be zoned for other use but are currently in residential use. Since the DHA property is zoned for residential use, DHA would have the option to request buffer cleanup for any area that exceeds the upper limit of background for arsenic.

5. DHA believes that the proposed action levels for cleanup of soil and groundwater should be as stringent as necessary both to protect public health and the environment and to ensure the long-term economic viability of the affected properties. Contamination levels above background may not be adequate to prevent unacceptable risks to the health of the members of the community or to the economic vitality of the properties in the community. DHA requests that Asarco and the state adopt these dual goals and set action levels which meet both goals. DHA's concern is most acute for the soil action levels for cadmium. It is critical that the state and Asarco fully consider and adequately document that this level protects the economic interests of the neighborhood as well as health and environmental ones. This is particularly true given that the Proposed Plan calls for much contaminated soil to be contained on the Asarco Globe Plant site itself.

The primary goal of this CERCLA action is to achieve a cleanup that is protective of human health and the environment. The action levels that have been set for soils are protective of the health of the community. For a discussion of the soil action level for cadmium related to health protection issues, see the Introductory Remarks section of this Responsiveness Summary.

We intend to work with the community, the press, and the lending community to address cleanup related economic issues such as local property values. However, it is not the purpose of CERCLA to ensure the long-term economic viability of any community. Under CERCLA, our actions are limited to cleanup related costs, and do not extend to claims for personal injury or property damage.

6. Figure 2 of the Proposed Plan, labeled "Ground Water Plume Map," seems to indicate that the suspected ground water plume may skirt the edge of the DHA property before turning away to the northeast. The Proposed Plan lacks sufficient detail on this point. In addition, the schedule for the proposed site remedy for groundwater is unclear. Again, cleanup should be accelerated wherever possible.

A review of the ground water data contained in the RI/FS shows that a cadmium and zinc contamination plume exists to the west of the site in the vicinity of well GW-25. This plume may be due to releases from a former fertilizer plant that existed between 53rd and 54th Avenue, east of Sherman Street. At one time, spent electrolyte was conveyed by buried pipe from the Globe Plant to the chemical plant (Sections 3.1.3 and 4.5.4, RI). Portions of this plume do appear to skirt the edge of the DHA property. It is our understanding that Asarco intends to expedite the ground water cleanup remedy as much as possible after the final Consent Decree is entered.

COMMENTS OF MICHAEL R. DUDYMOTT

My name is Michael R. Dudymott. I have lived in Globeville most of my life until 1983.

My family has over a 100 year history in Globeville. The reason I am writing this letter is because I feel morally obligated to do so. I was employed by Asarco and in 1990 I was injured on the job. During medical investigation into my back injury it was found that I have nerve damage, or neuropathy. I am still under litigation in both of those matters. Knowing the dangers of lead, cadmium, arsenic and other pollutants, I strongly agree with Theresa Donahue, and respectively urge you, Celia VanDerLoop, and the Colorado Dept. of Health to protect the citizens of Globeville and the State of Colorado, and not accept a plan for cleanup, proposal or solution to this problem unless it includes medical care for residents and citizens affected by it.

Because of concerns for the health of community members, CDH filed suit under CERCLA and pursued this action in order to gain cleanup at the Globe site. The cleanup will benefit the health of the community. The remedy will remove contaminated soils and sediments from the community and will reduce concentrations of air-borne contaminants. In addition, the selected remedy includes a medical monitoring program, described in the Selected Remedy section of the ROD, to determine if residents are experiencing measurable health effects from the site.

Regarding future health care, treatment for exposure to the metals of concern at the Globe Plant generally involves identification and removal of the exposure source. If the medical monitoring shows a person has high levels of Plant-related contaminants, the individual would be re-tested to verify the results. If the contaminant source is found to be Plant-related, then the source would be removed. The medical monitoring plan also includes provision for a part-time physician who will be able to provide referrals if warranted.

Occupational exposures often involve more severe exposures to chemical contaminants than those expected for environmental exposures. CERCLA does not provide the state with jurisdiction over occupational exposures.

COMMENTS OF EPA AS SUBMITTED BY ROBERT L. DUPREY

Risk Assessment:

The Public Health assessment was completed in accordance with EPA's Superfund Public Health Evaluation Manual. This document has been superseded by EPA's Risk Assessment Guidance for Superfund. As a result, the Public Health Assessment is inconsistent with current federal Guidance in some areas. The degree to which the inconsistencies impact the evaluation of risk to the community has not been closely evaluated. However, the action levels for soil and ground water do not appear inconsistent with action levels determined by EPA at sites with similar contaminants. EPA's evaluation of air emissions from the facility as well as our authority to limit those emissions, will be ongoing.

The Draft Globe Plant Public Health Evaluation (PHE), released in July 1989, was prepared during 1988 and 1989 by the Joint Investigation Team using the Superfund Public Health Evaluation Manual [SPHEM], published by the Environmental Protection Agency (EPA) in October 1986, and the Superfund Exposure Assessment Manual [SEAM], published in April 1988. In December, 1989, EPA issued Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A) [RAGS], the current guidance for preparing Public Health Evaluations (called Baseline Risk Assessments under RAGS) at CERCLA sites.

The current guidance states "[t]he Human Health Evaluation Manual replaces a previous EPA guidance document, The Superfund Public Health Evaluation Manual (October 1986), which should no longer be used. The new manual incorporates lessons learned from application of the earlier manual and addresses a number of issues raised since the earlier manual's publication. Issuance of the new manual does not invalidate human health risk assessments completed before (or in progress at) the publication date" (emphasis added) (RAGS, p. xv and xvi).

The draft PHE was released in July 1989, prior to the December 1989 release of RAGS. As such, the Globe Plant PHE does not need to be changed to conform with current guidance. However, the current guidance documents were reviewed and chronic daily intakes based on current exposure parameters and resultant estimated risks were calculated using the most recent guidance documents and toxicity data to evaluate any impact to the conclusions of the PHE due to the change in EPA guidance over time. These intakes and estimated risk levels were then compared with those that were included in the PHE. Since this is a comparison only, and is not intended to be a complete risk assessment evaluation using the RAGS guidance, default values from the RAGS guidance were used for exposure inputs. In addition, the maximum concentration values were used as the reasonable maximum exposure (RME) concentrations, rather than mathematically evaluating concentration data to determine 95% confidence intervals on concentration values. This results in a more conservative estimate of the RME than use of the 95% confidence interval RME.

A comparison of the calculation of the chronic daily intakes for the air pathway, the drinking water pathway, the home-grown vegetable pathway, and the soil ingestion pathway demonstrates that, although there have been changes in both exposure variable values and toxicity values, the resulting hazard quotients and excess cancer risks do not differ significantly between the two methods of guidance.

The PHE is used "to determine whether the contaminants of concern identified at the site pose a current or potential risk to human health and the environment in the absence of any remedial action" (NCP, 40 CFR 300.430(d)). The PHE clarifies what exposure pathways act as potential sources of risk, defines whether the risks posed by those pathways are significant enough to warrant remedial measures, and provides a methodology for determining levels of chemicals that can remain on-site and still be adequately protective of human health. Using both the PHE and RAGS methodologies, conclusions were the same regarding what exposure pathways act as sources of risk, and whether these risks are significant enough to warrant remedial measures.

The selected action levels for soil and ground water are consistent with those selected by EPA for similar sites with similar contaminants.

Former Neutralization Pond:

The evaluation of the applicable, or relevant and appropriate requirements (ARARs) and the "nine criteria" of the National Contingency Plan (NCP) for this Operable Unit (OU) was difficult to review in detail due to the brevity of the analyses in the FS and Proposed Plan. The Record of Decision (ROD) should include in more detail how the Neutralization Pond alternative, as well as the other alternatives, will attain ARARs and how the proposed alternative is cost-effective when compared to other alternatives. Also, the analysis of the applicability of RCRA should be further discussed in the ROD.

Neutralization Pond ARARs

A more detailed ARARs evaluation for each of the selected alternatives is presented in the Statutory Determinations section of the ROD.

The primary ARARs for the Former Neutralization Pond include the RCRA Subtitle C regulations for interim status facilities. In order to meet ARARs, the

Former Neutralization Pond remedy must meet the Colorado hazardous waste requirements of 6 CCR 1007. Subpart G, Sections 265.110 - 265.120, specifies closure and post closure requirements for interim status facilities. Section 265.111 gives general closure performance standards for these facilities. Under 265.111, the owner/operator must close his facility in a manner that a) minimizes the need for further maintenance; b) controls, minimizes or eliminates . . . the post-closure escape of hazardous constituents, leachate, . . . to waters or atmosphere; and c) complies with specific closure requirements for tanks, waste piles, surface impoundments, etc, as applicable. Subpart N details requirements for landfills.

The Former Neutralization Pond remedy includes a complex multi-layer cap to be designed and installed in accordance with EPA guidance (Design and Construction of RCRA/CERCLA Final Covers, EPA, 1990). The cap and the surrounding slurry wall will require minimal maintenance and will minimize the escape of hazardous constituents or leachate to the adjacent ground water or atmosphere. With the addition of the gravity drain system, inward gradients will be maintained to eliminate the post-closure escape of hazardous constituents or leachate. The drain collects contaminated ground water from within the slurry wall for subsequent treatment at the Plant wastewater treatment plant. Through time, concentrations in the collected ground water will decline such that the requirement for further maintenance is minimized.

Subpart N, Section 265.312 specifies requirements for closure and post-closure care. Closure requirements include a final cover designed and constructed to: (1) provide long-term minimization of migration of liquids through the landfill; (2) function with minimum maintenance; (3) promote drainage and minimize erosion or abrasion of the cover; (4) accommodate settling and subsidence; and (5) have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present. Post-closure requirements include monitoring, maintenance, surface water control, planning, and notification requirements. The selected remedy will comply with these requirements.

The remedy will be monitored to show that it is meeting the performance criteria of minimization or elimination of post-closure escape of hazardous constituents or leachate. The monitoring system will include:

a. The ability to measure concentration of contaminants in the ground water within the containment system and outside of the slurry wall. The data will have to show a decline in contaminant concentrations within the slurry wall, with eventual achievement of ground water standards (MCLs and non-zero MCLGs).

b. The presence of inward gradients throughout the containment system. Inward gradients must be present not only along the perimeter of the slurry wall throughout the depth of the slurry wall, but also beneath the contaminant waste mass as well.

c. Ground water levels within the slurry wall containment system will be brought below the bottom elevation of the waste pile, with an adequate safety factor. Ground water levels will continuously remain below this level, throughout the interior of the slurry wall.

d. The absence of contaminant migration from the waste pile into the ground water within the containment system will be monitored. It will be demonstrated that the waste pile does not release contaminants to the ground water on a continuing basis.

e. Volumes of collected ground water will be monitored. The collected volumes will be correlated to calculated estimates of volumes entering the containment system if the designed permeability of the slurry wall were maintained.

Cost-Effectiveness of Selected Alternative

The selected remedy is cost-effective in mitigating the principal threats posed by the site. Cost-effectiveness is determined by evaluating the following three balancing criteria to determine overall effectiveness: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost to ensure that the remedy is cost-effective.

The selected remedies provide the best overall effectiveness of all alternatives considered proportional to its cost. The selected remedies will provide long-term effectiveness and permanence by minimizing or eliminating the contaminants that leach into ground water from the neutralization pond; by cutting off contaminated ground water flow from the floodplain; by removing or covering contaminated community and Plant site soils and sediments; by cutting off Plant site sources of ground water contamination; and by further reducing the emissions from the on-going Plant operations. The selected remedies reduce toxicity, mobility, and volume through treatment by treating collected contaminated ground water from the Former Neutralization Pond and from the terrace drain; by stabilizing contaminated sediments as necessary; and by removing additional air pollutants from Plant emissions. Short-term risks will be controlled through use of good construction practices and institutional controls.

Alternatives 7 and 8 for the Former Neutralization Pond operable unit would also provide high overall effectiveness. However, these alternatives are significantly more expensive than the selected remedy. In addition, Alternative 8 involves off-site disposal, which is disfavored by CERCLA when practicable on-site technologies exist. For the ground water remedy, Alternative 9 would result in ground water restoration in the floodplain in a faster time frame. Again, this alternative is significantly more expensive. In addition, there is significant uncertainty regarding the ability of floodplain ground water extraction and treatment to completely restore floodplain ground water to levels below drinking water standards.

Ground Water and Surface Water OU:

The rationale and time frames for the natural attenuation of the contaminated ground water down to Maximum Contaminant Levels (MCLs) is unclear. Given the proposed alternative for this OU, control and monitoring of the ground water, reliable institutional controls, and tracking potential use of the contaminated ground water by citizens, are all fundamental aspects of the remedy for this OU which should be further developed by CDH.

See the Introductory Remarks of the Responsiveness Summary on the ground water remedy. This issue is also discussed in more detail in the Selected Remedy Section of the ROD.

The proposed alternative for this OU, as well as the proposed alternatives for other OUs, include many contingencies. While EPA accepts contingencies as part of final remedies, for sites, remedies involving contingencies are often difficult to develop successfully. Thus, the party or parties that would perform additional response actions, as a result of contingencies in a remedy, should be discussed in the ROD.

The state expects that the selected remedies will be protective and will function effectively. However, since this remedy is the settlement of a lawsuit, contingencies were specifically stated in some cases so that re-openers will be available to the state if necessary. Any additional response actions that result from contingencies will be performed by Asarco, or its successor.

The proposed remedy for the Asarco Globe site appears to be technically sound and utilizes a standard approach to contamination problems with soils. The control of air emissions from ongoing activities at this facility will require additional study from Region VIII staff, but should not interfere with implementation of the Air emissions remedy as proposed.

The comment is noted.

COMMENTS OF SENATOR DENNIS GALLAGHER

1. The boundaries of the cleanup area should not just include arsenic contamination but cadmium contamination as well, I am concerned about any plan which does not cover this health hazard to the neighborhood.

The soil action levels have been set at health protective levels for cadmium, as well as arsenic, lead, and zinc. Cleanup will be provided if any of the action levels are exceeded. For further discussion, see the Introductory Remarks regarding cadmium issues.

2. The plan for reduction of air pollution in cadmium from smoke stacks should also cover arsenic.

The arsenic emitted by the Plant results from arsenic impurities in the cadmium feedstocks, rather than separate processes. Therefore, any reduction in cadmium emissions will result in an associated reduction in arsenic emissions. The additional pollution controls and emissions cap specified for cadmium will result in reducing arsenic emissions to approximately a $2x10^{-6}$ excess cancer risk level.

3. I am concerned about the pollution to the water table by the waste pile and settling pond. Can the cleanup plan guarantee into the future, groundwater will be protected?

CDH expects that the remedies for the Former Neutralization Pond and the former sedimentation pond will prevent future ground water contamination. Monitoring will be conducted to determine if the remedies are effective. If the Former Neutralization Pond remedy does not sufficiently protect ground water quality, a contingency remedy will be implemented. In addition, under CERCLA, reopeners are available if any portion of the remedy is not protective of human health or the environment (ground water).

4. Above all, health protective measures for the neighborhood should be carefully considered by the agencies empowered to protect the neighborhood in review of the plan.

CDH has carefully reviewed the RI data and the remedial alternatives considered in the FS. The remedies selected are protective of the community health.

COMMENTS OF EMMA GONZALES

I am concerned that during the remediation of community soils, dust from the remediation activities will make my husband, who has lung problems and asthma, more sick.

> We do not anticipate that construction will be taking place in your immediate vicinity. In addition, short-term risks due to soil removal and replacement will be minimized through good construction practices. These include minimization of the area of excavation, covering all areas of unvegetated soil, and watering to prevent windblown dust. Ambient air monitoring will be conducted to ensure that extensive dust is not generated.

I am also concerned that the effect of construction work during the remediation activities of community soils will cause my house to crack further; recent construction work near my house has caused it to crack.

> We do not expect that soil removal activities will involve extremely heavy machinery that would cause your home to shake or crack further.

COMMENTS OF BOB JONES, E & J PROPERTIES, LTD.

Two large mounds of dirt are located on the northwest corner of 50th Avenue and Franklin St. directly across the street from our property. I wrote to the City of Denver Office of Asset Management regarding these mounds and have contacted Denver Street Maintenance. I have also talked to Debbie Ortega and her assistant Judy.

An unnamed lawyer said that the dirt was involved in the Asarco problem and would not be moved. I was not able to find out who this person was.

I want this dirt gone. It is an eyesore to our property.

> The mounds of dirt will be sampled during the sampling program conducted for the community soils remedy. If the soil is contaminated above action levels, it will be removed. If the soil is not contaminated, the property owner is responsible for removing the dirt piles.

COMMENTS OF METRO WASTEWATER RECLAMATION DISTRICT - Theresa A. Pfeifer, Industrial Waste Coordinator

The proposed plan states that the groundwater will be treated at Asarco's wastewater treatment plant, but does not state how the treated groundwater will be disposed of. If there is any intention to discharge the treated groundwater to the sanitary sewer system, approval must be granted by the Metro District and the City and County of Denver before the discharge would be allowed.

The Metro District would be very involved in any arrangements for the discharge, which must be in compliance with all District Rules and Regulations, as well as the requirements of the City and County of Denver. In addition, if discharge to the sanitary sewer is approved, a discharge permit would be issued by Metro and Denver detailing site specific pollutant limits, and requiring routine monitoring.

> The collected ground water will treated as necessary at the Plant wastewater treatment plant and discharged to 1) the sanitary sewer under Asarco's existing wastewater treatment permit; 2) surface water per CoPDES permit requirements; or 3) through underground injection (treatment would meet MCLs). The existing Plant treatment plant has sufficient capacity to treat collected ground water.
>
> It is our understanding that the existing wastewater treatment permit specifies treatment requirements, routine monitoring requirements, and volume limitations. Any discharge of treated ground water will meet these existing requirements or alterations to the discharge permit will be necessary and will be obtained.

COMMENTS OF ALBERT MONTOYA, SR.

My concern is regarding health. How will we be monitored? What if we get different sicknesses and no-one thinks its caused by Asarco?

The medical monitoring program will provide biological testing that will measure if an individual has elevated levels of cadmium, lead, or arsenic. The medical monitoring program is described in more detail in the Selected Remedy section of the ROD. Follow-up for individuals with elevated test results will include investigation of the source of exposure.

I don't think that 6 to 12 inches of top soil is enough because of water and erosion.

The comment is noted. The state considers the community soils remedy to be protective. The remedy requires establishment of vegetation, which will prevent significant soil erosion.

COMMENTS OF DENVER CITY COUNCILWOMAN DEBORAH L. ORTEGA, DISTRICT 9

I concur with the comments submitted by the City of Denver, however, my concerns go beyond that of the city's.

1. My first issue is a concern of environmental racism. This community is 64% Hispanic, Black or Native American. A September 21, 1992 issue of the National Law Journal included the findings of a comprehensive analysis of every US environmental law suit concluded in the past seven years, and found that the penalties for waste sites which were surrounded by or adjacent to white areas average $335,566.00, whereas the penalties for waste sites surrounded by or adjacent to minority area average $55,318.00. "In more than half of the ten autonomous regions that administer EPA programs around the country, action on clean up at Superfund sites begins from 12 to 42% later at minority sites that at white sites." The National Law journal article says that "using an increasing body of scientific study, they (activists with ties to both the civil rights and environmental movements) have shown that minorities bear the brunt of the nation's most dangerous pollution." They go to say that "at the minority sites, the EPA chooses 'containment', the capping or walling off of a hazardous dump site, 7% more frequently than the clean up method preferred under the law, permanent 'treatment' to eliminate the waste or rid it of its toxins. At white sites, the EPA orders treatment 22% more often than containment."

Since CDH only has jurisdiction within the boundaries of the State of Colorado, we cannot speak to national issues of environmental racism. CDH shares your concern about environmental racism and has convened a committee to consider how the HMWMD can be alert and responsive to these issues in the management of its remedial projects. The Asarco Globe site, while not a Superfund site, is being addressed under CERCLA and state law. Although it takes a long time to reach the Record of Decision and Consent Decree stages, the amount of time spent on this site is only slightly more than the national average of eight years. Some of that delay is attributable to working simultaneously on both a settlement and toward possible litigation of the NRDS lawsuit filed in 1983.

Although the remedy in the proposed plan calls for consolidation of contaminated soils and capping on site, we believe it to be a sound and reliable one. In addition, CERCLA disfavors off-site disposal of untreated waste if on-site management is practicable.

We have performed a brief survey of soil cleanup levels at other sites that include metal-contaminated residential soils. As can be expected, cleanup levels varied from site to site. However, our survey indicated that the Asarco Globe site community soils remedy is more stringent than any of these sites. Of these sites surveyed (cleanup in metals-contaminated residential soils), we found no sites with action levels for arsenic below 70 mg/kg, the required arsenic action level at the Globe site. The Globe remedy includes voluntary cleanup to the upper limit of background (defined as 28 mg/kg in the RI). No other residential soils cleanup included removal of arsenic-contaminated soils to background levels. Of cleanup actions that were driven by cadmium levels, no sites were found with lower action levels than the Globe cadmium action level of 73 mg/kg. Lead cleanup levels were generally within the 500 to 1000 mg/kg levels specified in EPA guidance. The Globe action level is 500 mg/kg for lead. The state's community soils cleanup action levels are lower than the following similar sites (metals-contaminated soils located in residential areas): Sharon Steel, Utah, where soil arsenic action level = 70 mg/kg, lead = 500 mg/kg, no cadmium level set; Tacoma Smelter, Washington, soil arsenic action level = 230 mg/kg, lead = 500 mg/kg, no cadmium level set; Asarco East Helena, Montana, interim lead action level = 1000 mg/kg, no action level set for cadmium or arsenic. The Smuggler Mine (Aspen, Colorado) cleanup recommendation included a lead action level of 500 mg/kg. EPA believed that this action level would result in cleanup of cadmium to 10 mg/kg. That is, when lead-contaminated soils were removed, the cadmium would also be removed. The 10 mg/kg for cadmium was not established upon any health-based criteria. Whether any residential soil cleanup will be undertaken at the Smuggler mine is currently in doubt, since the Aspen citizens convened an expert panel that concluded no residential soil cleanup was necessary to protect health.

2. I firmly believe that each individual with the state health department and the attorney general's office has done the absolute best job that he or she believed they could do, and I appreciate their effort. I am convinced that each time there was a change in staff in both state agencies, Asarco and legal representatives took full advantage of the opportunity to push for what they wanted. This is the issue I have referred to in previous meetings, with regard to a negotiated process, and the lack of continuous representation in the two state agencies.

Thank you for your acknowledgement of CDH and the Office of the Attorney General (AGO) staff for their work on this remedy. While it would be ideal to have the same staff representatives throughout any CERCLA project, staff turnover can be expected at any CERCLA site for both the agencies involved and for the responsible parties. Asarco and its legal counsel have also experienced staff turn-over during this process.

The current state representatives for the Asarco Globe site were briefed by previous state staff assigned to the Asarco Globe project and have extensively reviewed files containing thousands of documents and previous site studies. These briefings included information of site status, history, studies conducted, and state and Asarco positions. Other members of the state team, including CDH management, air program staff, and contractor personnel, have been involved with the Asarco Globe project since 1985.

3. The residents of Globeville do not have the financial resources, nor the expertise within their own community to fully analyze the volumes of data that have been released from the state health department. They have been reliant upon the state to be looking out for their interests, therefore I feel they have been at an extreme disadvantage.

It is the state's responsibility to represent state interests, including community interests, in its actions on this site. We believe that the state's actions in this case have fully and competently represented the community's interests, to the maximum extent allowed by CERCLA. Under CERCLA, the state's actions are limited to cleanup-related costs, and do not extend to claims for personal injury or property damage. The state is not authorized to act on behalf of individual citizens at this, or any other, CERCLA site.

4. The state's case against Asarco is based on the federal Superfund law. In 1986, an amendment to the Superfund law created the Agency for Toxic Substances and Disease Registry (ATSDR) and charged that agency with the responsibility of developing toxicological profiles and minimal standards in connection with many known toxins. The ATSDR completed its Updated Toxicological Profile on Cadmium with the close of public comments in February of this year (1992). According to ATSDR, people should not be exposed for more than one year to 10 parts per million (ppm) of cadmium in the soil. Despite this health protective level, the Colorado Department of Health has agreed with Asarco to permit 73 ppm of cadmium in the yards of residents who live and raise their families in Globeville. They have chosen an action level that is more than seven times the exposure that is recommended by the ATSDR.

See Introductory Remarks of this Responsiveness Summary regarding ATSDR's role in the CERCLA process and the cadmium Environmental Media Evaluation Guideline (EMEG).

ATSDR is not recommending an exposure level when they develop EMEG values. EMEGs are generic values developed for all sites as screening criteria when ATSDR conducts health assessments. The EMEGs are used to select environmental contaminants that should be further evaluated in the site-specific health assessment. CDH conducted further evaluation during the RI/FS process and developed a site-specific cleanup level. The Public Health Assessment Guidance Manual, when discussing how EMEGs should be used, specifically states that EMEGs **should not** be used for setting cleanup levels.

The draft Toxicological Profile contained a cadmium EMEG of 10 ppm. This value is being revised upward and will be withdrawn from the final Toxicological Profile.

5. Why is it that the medical monitoring plan (October 23, 1992 copy) looks at the long term and short term effect of exposure to lead, CADMIUM, and arsenic, via inhalation and ingestion, however, the soils action levels for cad.nium disregard the carcinogenic effects in the clean up plan for the soils? The health of the community is being compromised by not including the carcinogenic effects of cadmium in the action levels for the soils clean up. The carcinogenic effects must be included in determining the action levels for cadmium in the soils clean up. It is wrong for CDH to choose an action level, as they did here, by ignoring the carcinogenic effect of cadmium entirely. Cadmium is classified by EPA as a B-1 carcinogen when it is inhaled.

CDH has evaluated risk due to inhalation of wind-blown soils that contain cadmium. Using extremely conservative assumptions, the carcinogenic risk due to inhalation of windblown soil containing cadmium was calculated at a level of $3.5x10^{-6}$ excess cancer risk. This calculation assumed that 50% of airborne total suspended particulates originate from fugitive dust emissions; the soil is highly erodible, and that all soil is bare and therefore contributes to fugitive dust emissions. The total excess cancer risk, without including risk due to inhalation of wind-blown soil, due to soil exposure is $8x10^{-5}$, primarily due to ingestion of arsenic-contaminated soil (based on the soil action level of 70 mg/kg). Adding in the excess cancer risk due to inhalation of windblown soil containing cadmium, total excess cancer risk is $8.35x10^{-5}$. Due to the uncertainties involved in risk assessment, this value would be rounded to $8x10^{-5}$ excess cancer risk. Where soil cleanup takes place to the arsenic background levels, residual risk will be $3x10^{-5}$. arsenic would

In addition, the approach taken to calculate the risk estimate for windblown soil is conservative, i.e., assumptions made have maximized the estimate of exposure or dose. Current EPA guidelines recommend that if such a maximized estimate is not significant, the pathway can be eliminated from further assessment (US EPA, 1992, Guidelines for Exposure Assessment) EPA has defined "not significant" in this instance as "...either that it is so small relative to other pathways that it will not add perceptibly to the total exposure being evaluated or that it falls so far below a level of concern that even when added to other results from other pathways, it will be trivial."

6. An inadequate soils clean up will impact property values because they will continue to be burdened with contaminated soils, which in turn will effect their ability to sell their property or borrow funds, via a second mortgage. The bottom line is, without state indemnification of liability for these property owners, verifying the soils are clean and

no longer pose a health threat, the residents and businesses in Globeville will be negatively effected for years to come. I will be contacting Housing for All, to ask that Globeville be monitored to assure that red-lining does not become a reality. These concerns go back to my environmental equity issue. If the state is not willing to indemnify the residents from liability, then I recommend that Asarco set up a bank that Globeville residents can borrow from - especially in the event that red-lining becomes a reality. This recommendation is not being suggested, by any means, to replace the quality clean up that should transpire, with lower action levels.

The comment is noted. The Colorado State Constitution prohibits the state from indemnifying individuals or entities. The state will provide property owners with records of cleanup activities conducted on their properties and certifications of cleanup. The state intends to work with local lending institutions to inform them of the cleanup and that action levels are protective of human health.

7. A first class educational component must be incorporated with bi-lingual communication in writing and in talking with residents (and utilizing residents to help with the communication), both in person, one on one, and at larger community meetings. The state must make every effort to convince the community that the best clean up measure proposed (excavation and replacement) must be accommodated in order to reduce greater long term impact to property value. This educational component must also include communication with the Denver Board of Realtors and the lending community, after the clean up is done right, with the best remedy available, being recommended.

The comment is noted. The remedy includes an educational component to inform residents, both English- and Spanish-speaking, of the remedy components and factors involved in the soils remedy. Educational efforts will include community meetings, bilingual fact sheets, and individual consultations. As we have done in the past, we intend to provide Spanish translation when possible. As stated above, the intends to work with local lending institutions and with realtors to inform them of the cleanup status, including the status of individual properties as needed.

8. If Globeville were a white community instead of a minority community, there would be a thorough clean up of the Asarco Plant, and not just a minimal clean up which seems to be what CDH is requiring of Asarco in Globeville.

The comment is noted. The state disagrees. As noted in response to Ortega comment #1, a survey of similar sites indicates that the selected remedy meets or exceeds the cleanup levels that are required at other sites, including those that are located in predominantly white and more affluent communities.

9. Asarco should be required to clean up the soils on the Asarco site to the same level that they are being cleaned up in the community. Otherwise the Globe Plant will be a continuing source of contamination as cadmium, arsenic and lead blow from the Asarco facility into the neighborhood. The Plant does not have to do any clean up at all on the Plant site where the cadmium concentration is below 9,165 ppm. These very high levels of cadmium will blow across the fence at Asarco and be a continuing source of pollution in the community. The importance of fugitive emissions as a hazard to the people of Globeville has been ignored in the RI/FS studies. CDH's own documents show that this is so, that fugitives are a potential hazard and should receive careful attention in the RI/FS and PHE rather than to be ignored.

The possibility for fugitive emissions causing risk has been considered during the remedy selection process. The Plant site will be vegetated to prevent wind-blown dust. Percent vegetative cover standards will be established that must be met through time. In addition, deed restrictions will be established that require that vegetative cover be maintained. Any area that will not support vegetation will be covered through paving, additional soil such that vegetation will be supported, or other types of cover. Ambient air concentrations of the metals of concern are and will continue to be monitored at on- and off-site monitoring stations. Currently, the stations show very low readings for these metals when the Plant is not operating, indicating that fugitive dust is not a major source of contamination.

10. The state should require a clean up of the contaminated ground water that will remove the contamination from the ground water within my lifetime, rather than the state's proposed natural cleansing plan. Performance limits should be set at drinking water standards.

The recommendation is noted. Please see the Introductory Remarks of this Responsiveness Summary regarding ground water restoration. Performance limits will be set at drinking water standards (MCLs and MCLGs).

11. The proposed remedy for clean up of the neutralization pond is entirely dependent upon operation and maintenance and is therefore not a permanent remedy.

The state considers the Former Neutralization Pond remedy to be a permanent remedy. Off-site landfills also require some operation and maintenance, and are closed through capping systems similar to that selected for the Former Neutralization Pond. In addition, CERCLA disfavors remedies that include off-site transportation of untreated waste.

One of the modifying criteria under CERCLA for selection of the remedy is community acceptance, however, there is no basis by which the community can ascertain if the basic CERCLA criteria are being met. Therefore, I believe, as well as the city, that the

Proposed Plan should be modified to include all appropriate performance standards and risk information and then released for public comment. If the Proposed Plan is not rereleased, the state should commit to extend the existing comment period until the "scope of work" (which will contain such details) can be reviewed.

The Proposed Plan included tables for each Operable Unit that compared the various alternatives for the CERCLA evaluation criteria, and described if the alternatives satisfied the criteria. Performance standards, ARARs, and risk information were included in the PHE and the FS, all of which were made available for public comment in draft form and were available in final form for public review during the Proposed Plan comment period. This Record of Decision includes performance criteria and risk information as well. Another 30 day public comment period will be available upon lodging of the proposed Consent Decree with the federal court. The proposed Consent Decree will have an attached Statement of Work that further delineates performance standards.

I urge you to require CDH to do a complete reevaluation of the settlement that has been proposed with Asarco. I am particularly concerned with CDH's failure to require adequate clean up of the neighborhood and of the properties of the people who live in this community. It seems to me that this settlement is not in the best interest of Globeville or the State of Colorado. It opens the state to the charge of environmental racism.

The comment is noted. The state disagrees. The cleanup described in this Record of Decision will be protective of human health and the environment. We believe that it is in the best interests of Globeville, and the State of Colorado, to see cleanup take place to health-protective levels. This remedy allows that cleanup to take place.

COMMENTS SUBMITTED ON BEHALF OF 260 E. 54TH CORPORATION BY WILLIAM C. ROBB, WELBORN DUFFORD BROWN & TOOLEY, P.C.

The property of 260 E. 54th Corporation (Corporation) constitutes approximately six acres. Based upon our review of the Proposed Plan, particularly Figure 5 on the Community Soils Cleanup, it is unclear whether any soils sampling was done to the west of the Globe Plant in the vicinity of the property of the Corporation. The Industrial Drainage Ditch does cross the property, and the Proposed Plan contemplates that cleanup work will be done on the ditch.

Because of concerns over proximity to the Globe Plant, the Corporation obtained limited soils sampling on its property in March 1991. For a number of these samples the analytical results exceed the proposed action levels for arsenic, cadmium or lead. It is requested that soils sampling be conducted by the Colorado Department of Health or its agent pursuant to the cleanup plan. If the results confirm excessive levels of these metals in the soils on the Corporation site, it is requested that the remedial actions proposed for community soils cleanup include that property.

Please advise the undersigned when soils sampling is anticipated. We also request copies of any sampling results obtained.

Figure 5 of the Proposed Plan is based upon the soil sampling conducted during the RI/FS and is not intended to describe the exact boundaries slated for cleanup. Rather, it is intended to show general contaminant patterns and the general area where additional sampling will be necessary to confirm whether remediation is necessary. Decisions regarding whether properties will require cleanup should not be made based upon Figure 5; these decisions should be made based upon sampling conducted on the individual property. Additional property-specific sampling will be conducted to further delineate the edges of cleanup areas. While the sampling conducted in the RI/FS was sufficient to describe contaminant patterns, we will need to confirm the boundary of cleanup through additional sampling. More detailed soil contaminant maps can be found in the RI/FS reports.

The Statement of Work will contain schedules for planning, design, and remedial actions. For example, sampling for the community soils remedy is scheduled to take place in late summer and fall of 1993, followed by remedial design and obtaining access for construction in the winter of 1993-1994, with soil removal beginning in 1994. Order of remediation will progress from required residential areas, to commercial properties, to voluntary residential areas.

Once properties have been remedied, the state intends to provide land owners with a letter establishing that their property has been cleaned. We also plan to make available to property owners construction documentation results, including the results of testing and the extent of cleanup performed. During remedial activities, the state will work closely with property owners to inform them of the status of cleanup plans, plans for further sampling, and plans for remedial action.

COMMENTS OF PHIL VALDEZ

When I purchased properties in 1960, I was not aware of Asarco. Now I can't rent them, my property values have dropped.

The state filed suit under CERCLA in order to get the site cleaned up. Under CERCLA, our actions are limited to cleanup related costs, and do not extend to claims for personal injury or property damage. The state is not authorized to act on behalf of individual citizens, but rather on behalf of the general public.

I also used to garden a sizeable piece of ground, as do some of my tenants. Now we have stopped planting because of contamination from Asarco.

Removal and replacement of up to 12 inches of soils in community yards should both remove most of the contamination and prevent exposure to any remaining contamination. The additional 18 inches in gardens provides a safety factor in case plant roots extend that deep. It will be safe to garden once cleanup has taken place.

I am concerned with my health and the health of my tenants. We had a tenant whose little girl came down with lead poisoning. At the time we didn't know about contamination from Asarco.

Because there are several common urban sources of lead exposure, it is difficult, and may be impossible, to determine whether prior health effects are due to exposure from metals from the Globe Plant. The remedy protects community health by removing or covering contaminated community soils and limiting emissions from the Plant. The medical monitoring program will provide biological testing that will measure if an individual has elevated levels of cadmium, lead, or arsenic. If elevated levels are found, follow-up testing will be provided to help determine what the source of the elevated levels could be.

COMMENTS OF FRANK J. WINTERS. JR., PRESIDENT & EXECUTIVE DIRECTOR/MARIJA CERJAK SOC.

They should clean up the land, air, and water, but they shouldn't let Asarco stay there.

The selected remedy allows us to clean up soils, ground water, sediments, and the Former Neutralization Pond, and allows us to reduce air emissions via the emissions ceiling and installation of further air emission controls. Lengthy delays in the entire cleanup would result if the were to seek a court order to close the Plant. In addition, there would be no guarantee of the success of such a lawsuit.

Many members of Mr. Winters' family died of lung disease and cancer. The Globe Smelter killed many good people.

Because there are many potential causes of lung disease and cancer, it is difficult, and may be impossible, to determine if ailments are due to exposure from metals from Globe Plant emissions, if they could be due to industrial exposures during working hours, or if they are due to other causes.

Asarco should clean up soil, air, and water to higher standards than any national standard.

The remedy requires that the cleanup meet all federal and state ARARs, or environmental standards.